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Technocracy and Social Trends

We are all concerned with current social trends. They affect us personally. Has Technocracy anything to contribute to an understanding of these trends or shall we turn for guidance to men and women who have made a life study of them?

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"Our old system is done for, and the nation has got to swallow the fact that the price system is completely played out." Thus Howard Scott, director of the Energy Survey of North America, and founder member of Technocracy, sums up the findings of his colleagues in the January *Harpers*.

STATEMENTS like this one, whether founded on fact or on a questionable interpretation of more or less accurate statistics, are apparently sure-fire means of arresting public interest in these United States. At any rate Mr. Scott and his coworkers have used them with telling effect in public addresses, in magazine articles, authorized and otherwise, and in newspaper interviews. Not a little has been added to the effect by the adroit invention of the term Technocracy which sounds enough like technology to awe the average citizen and enough like some new kind of government to awaken his curiosity. Say what you will about this latest sensation which has set everyone talking, you have to admit that its sponsors either know a lot about publicity and mass psychology or else that they have been precipitated into the limelight by a most remarkable coincidence.

But the very suddenness of its popularity or notoriety leads one to suspect that its decline may be equally abrupt. Mah Jong came upon us quickly and faded as rapidly a few months later. But is it fair to compare so serious a research group as the technocrats with so frivolous an occupation as the old game of the mandarins? For the technocrats unquestionably take themselves very seriously, and they number among them some men of unquestioned professional attainment.

Perhaps the best way to answer this question is to try to determine whether there is any more logic in the conclusions of Technocracy than there is in your chance of drawing a green dragon rather than the five circles tile from the Mah Jong table. Admittedly the latter circumstance is largely luck.

As nearly as I can determine from the authorized statements of Technocracy and from an interview with several of its leading lights, the basis for its flat statement that the price system is done for lies in the fact that man has discovered in the last 50 years how to multiply his productive power many times by turning to use through machinery the stored energy of earlier geological periods. Energy being measurable in accurate physical units and prices being essentially fluctuating in their nature their can be no satisfactory relation between the two. Since everything we do or have or hope for depends upon the application of energy then naturally we must measure it in terms of physical accuracy. Hence the price system collapses.

A good technocrat can take an hour to develop that argument, and do it in a very interesting way, but that seems to be the gist of the matter. I am nec-

essarily a trifle cautious in stating positively that that is really it because I have listened to much abler men than myself try to pin a technocrat down to a definite proof in words that anyone can understand, and I have yet to hear one succeed. Each time the expositor of the new faith has emitted a smoke screen of polysyllabic words that meant practically nothing to the baffled listener and has hidden behind it. I fear my metaphor may be a bit mixed but it is no more confused than those who have tried to question Howard Scott after one of his talks on Technocracy.

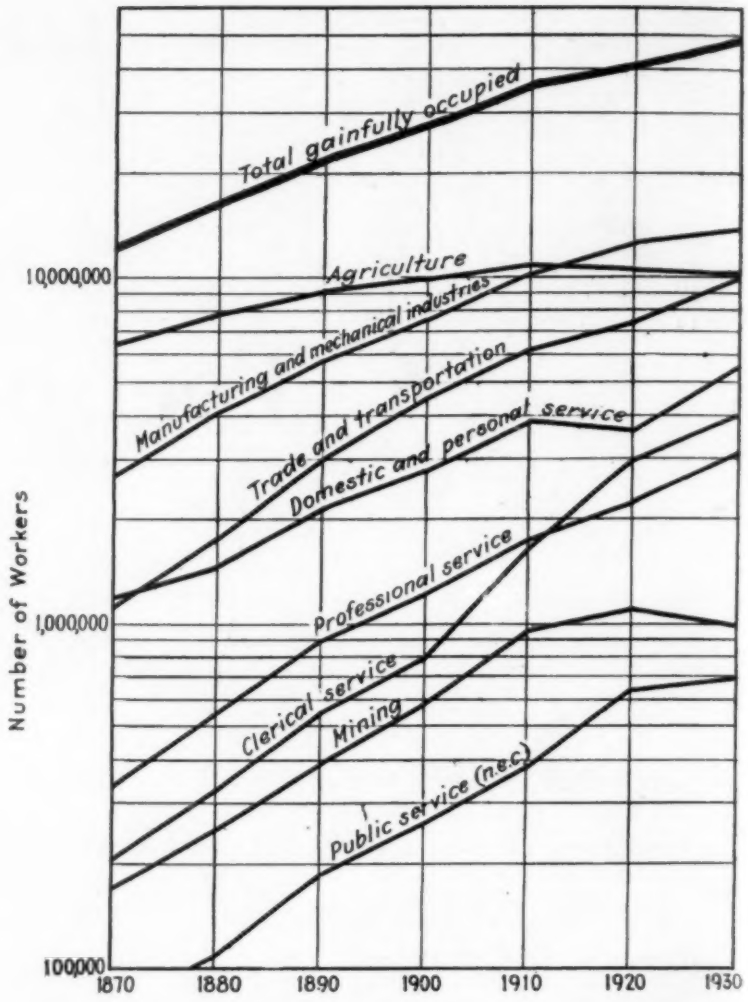
If Technocracy has anything constructive to offer it is most unfortunate that its spokesmen are unable or unwilling to clarify their meaning. I have talked with a number of open-minded people who have gone to scheduled addresses on Technocracy and have secured from them only expressions of disgust at the utter futility of the presentation.

Disquieting Claims

Corollary to its ultimate conclusion that the price system will no longer work are two other statements that are most disquieting if true. One is that unemployment will steadily increase so long as we stick to the gold standard or any other equivalent standard of value, and that hits the working man right between the eyes. Unless they can substantiate this statement beyond the question of a doubt the technocrats are guilty of one of the cruellest attacks ever made. The other statement is that debts are increasing and must continue to increase so long as business is conducted for profit. And this one strikes terror to those who have acquired corporate bonds to support their declining years, and to the dependent heirs of men who have sought to provide for them by similar investments.

Since the latter of these two corollaries affects fewer people, suppose we consider it first, and get it out of the way. In the *Harper* article Mr. Scott mixes up railroad bonds, equipment trust certificates and dividends with blithe abandon. He asks, "Is it clear that those bonds are to pay for locomotives that will long since have rusted away, equipment long since worn out and discarded, pay perhaps for a railroad that has ceased to exist?" And the answer of course is no, because bonds are not used to buy locomotives. Equipment certificates are usually classed as short term securities and they are designed to be retired well within the life of the motive power or rolling stock which they are used to purchase.

As for the bonds themselves it has long been evident that the railroad bond structure is insecure. Part of the insecurity comes from the old days of the railroad buccaneers, whose sole purpose was to milk the public, and part from the sort of restrictive regulation that has prevented most of the railroads from making enough profit to retire their bonds and improve their debt structures.



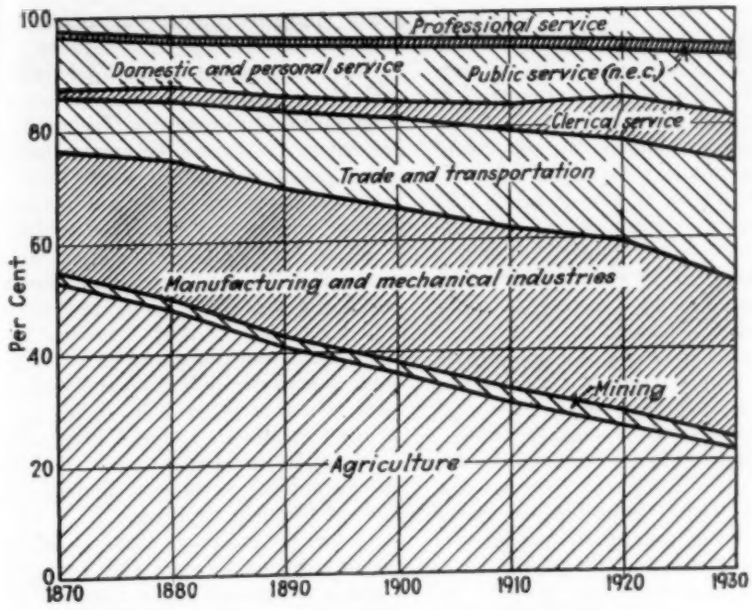
From 1870 to 1930, the total gainfully employed increased steadily; the manufacturing and mechanical industries kept pace with the general average

Why take an obviously abnormal debt situation like this and reason from it that all debt is based on the same unsound foundation? Doesn't Mr. Scott know of the many big corporations that retired their whole bonded indebtedness during the prosperous years before this depression overtook us, or of others that have used part of their cash surpluses to retire bonds by buying them in the depressed market of the last three years? He says that the great corporations "are almost stripped bare" of their surpluses. Well, undoubtedly the badly managed ones are, but there are many others that can continue, even on the present basis of low output and annual loss, for many years to come. I know of at least one machine tool builder who can go on for another ten years, and his industry is working at less than ten per cent of capacity.

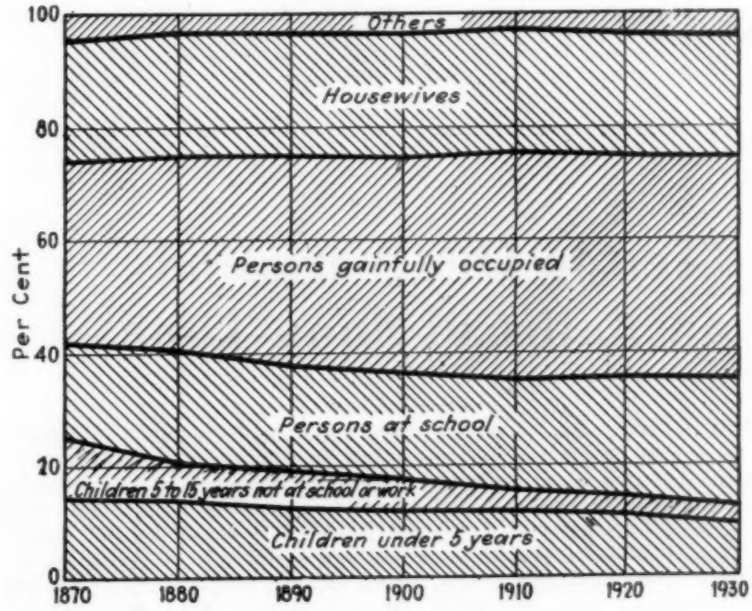
Reasoning on this basis I could prove that chain stores are doomed to early failure because one store in my town is losing money. I happen to know that that store should never have been established, because the rent on its location is too high to be supported by the amount of business that can be done in the community. But does that prove anything beyond the fact that the scouts who recommended its establishment made a bad mistake?

As for dividends, I should like to believe that the dividends I have not collected lately on the few common stocks I own could be counted as debts owed to me and on which I might expect payment later when business recovers. I fear that any such expectation is as unjustified as Mr. Scott's inclusion of dividends in the debt structure.

Furthermore, the statement that the very small fraction of our population



Percentage distribution of gainfully employed persons over sixteen years of age shows a gain in trade, transportation, and service occupational groups at the expense of agriculture



A survey of the primary activity of the total population indicates a growing percentage gainfully employed

which invests money cannot possibly spend its dividends on anything but reinvestment in production facilities is hard to accept. The Ford family is cited as an example, but no mention is made of the Rockefeller Foundation or the Carnegie libraries. Ford profits of 1930 are presented to prove the contention. But what of the losses of the preceding years when Ford was changing over from Model T to Model A? Careful observers are convinced that if Mr. Ford did better than break even on the Model A project he did very well.

Looked at from another angle the Ford example is not such a fortunate choice because it is an abnormal case. Take another automobile company, the Packard Motor Car Co. It has just announced that 111,000 people held its stocks on December 13, 1932, as against 60,000 on April 1, 1930. Apparently the small fraction of investors is growing in size. As it grows, the dividends per investor, assuming that the total number of shares remains constant, diminish and the chance of spending them on consumption increases.

Mr. Scott announces in the "Personal and Otherwise" department of *Harpers* that "Technocracy is a research organization composed of scientists, technologists, engineers and workers in other technical fields . . . has no interest whatever in programs or propaganda of a political or economic nature. Its work has been, and consistently remains, within the field of rigorous quantitative analysis of social phenomena."

Social Trends Report

If you will read the article in *Harpers* carefully you will probably have difficulty in reconciling with the statement just quoted the evident effort to build a case for the theory that the price system is collapsing. Facts favorable to the theory have been emphasized; those unfavorable have been ignored. I, for one, when I first heard of Technocracy, looked hopefully to it for fundamental facts on economic and social trends that would help us in our endeavor to hasten recovery from a serious depression. Like many others I have been disappointed and disillusioned. Fortunately, however, a really comprehensive study of these facts has just been published by the McGraw-Hill Book Co. for the President's Research Committee on Social Trends. This committee has been at work for three years on its task. Instead of hiding its membership and collaborators behind a screen of mystery as has been the case with Technocracy, it lists them all—in twelve pages of small type.

Technocracy, in discussing the results of its research, predicts widespread unemployment and imminent social collapse unless the existing economic system be immediately revolutionized on a basis that eliminates standards of value. Contrast that conclusion with the final paragraph in the report of the findings of the Research Committee on Social Trends. It says:

"In the formulation of these new and emergent values, in the construction of the new symbols to thrill men's souls, in the contrivance of the new institutions and adaptations useful in the fulfillment of the new aspirations, we trust that this review of recent social trends may prove of value to the American public. We were not commissioned to lead the people into some new land of promise, but to retrace our recent wanderings, to indicate and interpret our ways and rates of change, to provide maps of progress, make observations of danger zones, point out hopeful roads of advance, helpful in finding a more intelligent course in the next phase of our progress. Our information has been laboriously gathered, our interpretations made with every effort toward accuracy

and impartiality, our forecasts tentative and alternative rather than dogmatic in form and spirit, and we trust that our endeavors may contribute to the readier growth of the new ideals, ideas and emotional values of the next period, as well as the mechanisms, institutions, skills, techniques and ways of life through which these values will be expressed and fulfilled in the years that are to come."

Accelerated Unemployment

I have taken the liberty of digressing to this extent from the main theme because in this new study of social trends are facts that cast considerable doubt on Technocracy's conclusions regarding unemployment. In all of the statements released by Technocracy emphasis is placed on the accelerating unemployment attributable to the use of the machine. The *Harper* article includes this statement: "A producer does not install machines in order to give his empolyees more leisure; he uses machines because they multiply many times over the output of which his employees were capable and at a faster and much cheaper rate."

Some employers, it is quite true, have had only this one thought in mind. But there are other points of view, and other practices. For instance, in *American Machinist*, Vol. 76, No. 37, page 1193, K. T. Keller, vice-president and general manager of the Chrysler Corporation says, "We have gone out of our way in the Chrysler plants to eliminate the man-killing jobs. By doing so we believe that we are sending operators home at night not too tired to enjoy their families or go to the movies, or even to help the market for automobiles by doing their bit toward wearing out the ones that are on the road." In other words, this corporation recognizes the dual function of producer and consumer in its employees and proposes to help its own selfish interests by making its employees better consumers. This attitude is typical of the best thought in modern industrial management, which is not so blind as the technocrats would have us believe.

In "Recent Social Trends" there is a table showing the number of hours worked per week, in 1890 and in 1928, in major industries. The period varies in different trades but in the opinion of those who prepared the chapter on labor the probable decrease in the normal work week over the last 50 years is about twenty hours. It seems perfectly evident that the trend will continue in the same direction but the fantastic figures suggested by Technocracy can hardly be reached without a much greater installation of modern machinery than we have yet achieved. Don't forget that at least half of the metal-working equipment in place is more than ten years old, and therefore hardly capable of the labor saving anticipated in Mr. Scott's studies.

Technocracy dismisses the transfer of labor from industry to industry in this fashion: "There is a contention that labor which is thrown out of work by the machine in one industry is able to find employment in another. But figures covering a long period of years prove beyond contradiction that this is not the case. The high-water mark of industrial employment in America was reached in 1918, and ever since that time . . . it has been steadily falling."

This statement is not borne out by the figures culled from the occupational census by the Committee on Social Trends. It is true that a relatively smaller proportion of the population is engaged in manufacturing, but the actual numbers were greater in 1930 than at any time in our history. The three charts reproduced from "Recent Social Trends" illustrate the important changes in relative importance of the major occupations, and the numbers of individuals engaged in each. They are worth study by anyone engaged in the design or construction of machinery.

One could go on almost indefinitely with this sort of discussion, but enough has been said to prove that Technocracy has not as yet found the answer to the major questions now worrying us.

But the questions remain and we must find an answer to them. I should like to go on quoting the fascinating statements of facts and trends from "Recent Social Trends," but space forbids. I will say, however, that I believe that this presidential research committee has done a masterly job in marshaling its facts, and that in so doing it has given us the background material from which some bright mind is going to find the way to prevent, or at least diminish, the force of the next depression.

As for Technocracy, although its apparent attempt to scare the layman to death is reprehensible, the results of the attempt may lead to good if the average citizen is frightened into taking an active interest in economics and working for a better mode of life. George has most certainly failed him this time, and the sooner he undertakes the job himself the better for all of us.

Ten to One Variations in Railroad Shop Time

OBSERVATION has shown a wide variety of practice on the many jobs that go to make up the daily work of locomotive repair. Detailed information concerning a number of specific operations verify these observations. Some of this information from railroads in different sections, all of good size, has been tabulated, as given below.

One of the striking features of the information that has been collected is the wide variation in practice in the different shops. The only exception is tire turning, where cutting speeds and feeds are much more uniform than in other operations, although even here there is a variation of from 65 to 112 min. on the same size tire. On axle turning, however, there are variations of 20 to 1 in the amount of surface finished per min. On crank pins the variation is less marked but there is a variation of 10 to 1 on the same basis. One striking difference is seen in the time for turning the wheel fit for 8x25 in. crankpins, where one shop requires 2 hr. and the other 20 min., or one-sixth as long.

Such a discrepancy in machining time and consequently in costs indicates that a much wider interchange of ideas as to both methods and equipment is a vital necessity, especially for those shops that are taking the longest time. In view of the urgent need for reduction in maintenance costs on many railroads, it would seem as though one of the first things to be done would be to find the reasons for the lower costs on other roads. If it be found that the reason for the longer time required is poorer machine equipment, what better evidence could be presented to the management of the need for new machines at the first opportunity? On the other hand, methods may be partly responsible for the difference, in which case some of the desired savings can be put into effect in a short time. In either case greater standardization in equipment or practice, or both, would evidently be beneficial in many ways.

A study of the data received from a few well known railroads made it seem best to compile a portion of it in tabular form. This shows a great variety of practice, especially in the turning of axles and crankpins. Comparisons are difficult owing to the great variety of sizes, but by showing the area of each axle or crankpin and dividing this by the time given, the square inches of area turned per minute can be easily compared. As the depth of cut is probably about the same in each case, the area gives a comparison as well as though volume or weight of chips were considered. Direct comparisons can be made in the few cases where similar sizes are used by two roads, and some of these comparisons are very striking, varying as much as one to six.

TIRES

R.R.	66"	72"	84"	Cutting Speed	Feed R
1	90	110	...	12'6"	1/16
2	75	...	...	23'	1/4
3	90	90	105	14–20'	3/32
4	80	84	86	14	1/4
5	112	...	...	17	1/8
6	75	75	...	18	1/8
7	65	75	...	15	1/8
8	72	72	...	30	1/4

AXLES

R.R.	Size of Axle	Surface Area	Time Mins.	Sq.In. Per Min.
5	5½x10	172	15	11.4
5	6 x11	208	15	13.8
8	8 x11	277	60	4.6
3	9 x12	340	180	1.9
8	9 x13	368	60	6.0
3	10 x12	377	180	2.1
7	10 x12	377	30	12.6
5	10 x13	408	90	4.5
2	10 x20	630	480	1.3
1	10½x13	426	450	0.95
6	10½x17½	548	110	5.0
3	11 x14	482	240	2.0
6	11 x14½	503	95	5.3
4	11 x22	760	140	5.4
4	11½x13	470	116	4.0
6	11½x14½	526	95	5.5
4	11½x22	796	192	4.1
6	11½x23½	850	120	7.1
5	12 x13	490	120	4.1
1	12 x14	526	480	1.1
7	12 x14	526	35	15.0
4	12 x20	754	172	4.4
7	12 x20	754	40	19.0
3	13 x22	900	360	2.5
7	13 x22	900	45	20.0

CRANK PINS

	Crankpins		Time In Minutes			Sq.In. Per Minute			Time In Minutes
R.R.	Size of Pin	Surface Sq.In.	Rough Turn	Finish Turn	Roll	Rough Turn	Finish Turn	Roll	Wheel Fit
8	4¾x 6¾	100	210	30	30	0.48	3.4	3.4	30
3	5½x12	208	45	20	20	4.6	10.5	10.5	80
7	5½x12	208	40	20	10	5.2	10.5	21.	20
5	5½x15	260	105	65	..	2.5	4.3	..	55
4	6 x11½	215	14	8	6	15.	25.8	36.	32
4	6 x14½	272	15	22	7	18.2	12.5	39.5	33
3	6 x16	302	60	30	30	5.	10.	10.	95
7	6 x16	302	50	25	15	6.	12.	18.1	20
8	7 x 7½	158	210	30	30	0.76	5.	5.	30
3	8 x25	628	120	80	40	5.2	7.8	15.6	120
7	8 x25	628	80	45	20	7.8	14.	30.	20
4	8½x24½	650	30	24	17	21.	27.5	39.	34
6	9½x23 11/16	700	60	35	10	11.5	20.5	72.	60
5	9½x25	735	180	120	..	4.2	6.3	..	...
6	10½x26½	855	75	45	15	11.4	21.7	65.	70
6	10½x26¼	860	75	45	15	11.5	22.5	68.	70

Data received concerning driving boxes, crown brasses and shoes and wedges cannot be satisfactorily tabulated. The planer predominates in machining driving boxes for shoes and wedges, although both shaper and milling machine are used, the shaper being in favor where boxes are machined singly. The slotter still holds sway in machining the driving box for the crown brass, although the shaper is also used in some shops.

Crown brasses are turned on the outside in the majority of cases, but the shaper also has its advocates. The turning is done either in the lathe or in the vertical turret lathe.

Shoes and wedges are planed in nearly every case, although some are milled with gang cutters. Steel, cast iron and bronze are the materials used for these parts.

The time given varies as widely on these operations as on those tabulated. Without knowing conditions more thoroughly it is difficult to pick the most efficient method. Milling, where used, makes a good showing, but this may indicate only that these shops have more recent machine equipment, or that other conditions are better. The great discrepancy in time is startling to one who has only visited large production shops in other industries. To those familiar with locomotive repair shops, however, the differences are not so surprising, as these shops differ widely in equipment. But while methods may also vary, it is safe to say that the new machine equipment and its influence on the personnel is the greatest single factor.

Three tables are given, the first dealing with axles from 5½x10 to 13x22 in. Here the machining rate varies from 0.95 to 20.0 sq.in. per min.

Tire turning is compared in the second table, variations being less marked in this operation. Comparison of roads Nos. 7 and 8 is of interest. The cutting speed in No. 7 is but one-half that of No. 8 with the same feed in each case. Yet No. 7 shows less time on the 66-in. wheels and but 3 min. more on the 72-in. wheels. Assuming that the time given is correct it seems evident that railroad No. 7 must have much better handling facilities than No. 8.

Crankpins also show a wide variation in time, both as to the connecting rod bearing and wheel fit. With one exception pins are finished at a much faster rate than they are rough turned, sometimes as much as three-to-one. It is probably safe to assume that the results in general reflect the age and condition of the machine equipment.

Sensible Tolerances

JOHN E. HYLER

Perhaps there will not be found one case in a thousand where a designer, in specifying tolerances for various machine parts, will be found to have erred on the side of liberality. Rather, the tolerances required by him will be found to be more strict than is necessary. Why? Undoubtedly it is because he is chiefly interested that the machine for which he is largely responsible may prove to be satisfactory in every way. He knows full well that close tolerances will never cause him trouble in this respect, though too much liberality might do so. If he is in doubt, he simply makes the tolerances closer for safety.

This practice has for its commendation the fact that it represents safe practice. But we must also remember the other side. Too close tolerances, when used more or less continuously, add much to the cost of manufacture. It seems to me that it might be wise to have a competent shop man or two go over the plans for a new project with the particular idea in mind of loosening up on specifications that are unnecessarily tight. The designer would certainly not object, for he would have someone with which to share the responsibility, and as King Solomon once said, "In the multitude of counsellors there is safety." At any rate, such a method would go far toward relieving the shop of unnecessary cost of too-close tolerances.

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Modern Motor Methods

I. Cylinder Blocks

BUILDING motors for automotive purposes involves numerous operations, but the more common ones are milling, boring, drilling and tapping. With production running into millions, the larger motor building shops are mostly equipped with highly specialized machines, many of which have been designed and built particularly for this kind of work. These machines, taken as a whole, represent the best brains of both the machine builders and the production engineers in the plants using them.

While the problems presented to each plant may be said to be quite similar, and have naturally been met in somewhat the same manner by the various engineers, there is enough difference in the methods used to allay any fear of such standardization as will cause stagnation of ideas or prevent individual initiative. Personal preference as to types of machines to be used, different designs of parts, and the quantity to be produced will always tend to prevent exact duplication of methods except in minor operations, and induce the evolution of new and better practices.

A study of the accompanying tables, which have been compiled from the operation sheets of well known motor builders, will give a comprehensive outline of present day practice on cylinder blocks. These tables came through the courtesy of concerns who prefer to remain nameless, the designating letters bearing no relation to their identity. Although each builder starts the machining operations on the top or bottom of the cylinder block, some select one and others the other. Two, for example, rough and finish both top and bottom at the first operation, using a drum type miller; the third finishes the bottom first while the fourth finishes the top as the initial operation. Maker B grinds the bottom surface as his second operation, while D grinds the top of the block as operation 37. All ream certain holes in

Cylinder Blocks—Motor A

Operation No. - Kind	Machine Used	Tools	Remarks
1. R and F bottom	Rotary miller	H.S. and Stellite Cutter	30 per hr. per mach.
2. Drill and ream locating holes	Vertical drill	Hydro-pneumatic feed	30 per hr. per mach.
3. R and F top	Rotary miller	H.S. and Stellite Cutter	30 per hr. per mach.
4. R bore cyls.	Boring machine	4 blades per cutter	15 per hr. per mach.
5. R and F side and bearing cap flanges	Special miller	H.S. and Stellite	10 per hr. per mach.
6. R mill both ends	Drum miller	H.S. and Stellite	15 per hr. per mach.
10. Inspect milling	.....	Gages to inspect all milled surfaces	.....
11. Drill 102 holes	3-way drill	Groups of 20-43 and 39 drills	30 per hr
12. Drill 80 holes	4-way drill	Groups of 18-22-23 and 17 drills	30 per hr.
24. Tap 44 holes	3-way drill	Groups of 4-22 and 18	35 per hr.
25. Tap 85 holes	3-way drill	Groups of 31-39 and 15	35 per hr.
28. R bore crank and cam bearing	Horiz. boring machine	Fixture and boring bars	15 per hr.
29. Straddle mill main bearing	Rise and fall miller	H.S. side milling cutters, boring bars, gages	32 per hr.
33. F cyl. bores	Special	Fixture	12 per hr.
34. Chamfer top of bore	Vertical drill	Fixture cutter and gages	40 per hr.
36. Chamfer bottom	Vertical drill	Fixture cutter and gages	35 per hr.
37. F ream bore	Vertical drill	Fixture cutter and gages	11 per hr.
38. Mill rod clearance	Vertical drill	Fixture cutter and gages	30 per hr.
39. R and F hone bore	Honing machine	Use mineral seal oil	30 per hr.
40. Wash and blow out	Washing machine	.....	35 per hr.
41. Water test	Fixture	.....	.....
43. Inspect	Bench	Gages	.....
44. Tap bearing studs	Vertical drill	Fixture, taps, gages	30 per hr
45. Drive studs	Stud setter	Height gage	16 per hr.
48. Assemble caps	Nut driver	Driving tool	.....
49. F bore cam and crankshaft holes	Horizontal boring machine	Fixture and boring bars	8 per hr
50. F mill housing end	Drum miller	Fixture and tools	20 per hr.
51. Final inspection	Gages for squareness bore, shaft bearings, etc.		
52. Repair bores	Hones for repairing bores		

R = rough. F = finish.

Cylinder Blocks—Motor B

Operation No. - Kind	Machine Used	Tools	Remarks
1. R and F mill top and bottom	Drum type mill	Cutters 7 in. to 16 in diam.	.....
2. Grind bottom surface	Rotary table grinder	Segmental abrasive wheels	Magnetic chuck; tolerance 0.050 in.
3. Drill and ream locating holes	Vertical drilling machine	Combined drill and reamer	Gage position of holes to locating points. Tolerance 0.0015 in.
4. R and F mill both ends	Drum type mill	Cutter 10 in. to 13 in. diameter	Tolerance 0.020.in.
5. R cyl. bores	Vertical, multi-spindle machine	Cutter heads	Tolerance 0.020 in.
6. Semi-finish bores	Vertical, multi-spindle machine	Cutter heads	.....
7. F cyl. bores	Vertical, multi-spindle machine	Cutter heads	Tolerance 0.010 in.
8. Brinell test hardness	Vertical, multi-spindle machine	Cutter heads	.....
15. F ream valve guide holes	Vertical drill	.....	Tolerance 0.001 in.
16. Water test	.....	.....	.....
17. R bore cam bearings	Vertical	Boring bars	Tolerance 0.010 in.
18. R crank and F cam bearings	Horiz. boring machine	Boring bars	Cam shaft holes 0.005 in
21. Straddle mill main bearings	Special miller	.....	
22. Chamfer top of cylinder		.....	
24. Drill top and bottom	2-way drill	Groups of 23 and 38 drills	
25. Drill both ends	2-way drill	Groups of 5 and 12 drills	
26. Drill both ends	3-way drill	Groups of 8, 2 and 23 drills	
27. Chamfer bottom of bore	Vert. drill	.....	
39. Tap top and bottom	2-way	Groups of 22 and 34 taps	
40. Tap both sides	2-way	Groups of 8 and 18 taps	
41. Tap both ends	2-way	Groups of 13 and 6 taps	
44. Ream cyl. bore	Vert. machines	.....	
45. R hone	Vert. machines	.....	
46. F hone	Vert. drill	Bores finished singly	
47. Inspect	Gages, gage setting tool, etc.		
48. Wash	Standard machine		

Cylinder Blocks—Motor C

Operation No. - Kind	Machine Used	Tools	Remarks
1. R and F mill top and locating pads	Drum type mill	H.S. and T.C. cutter	11 and 12 in. cutters
2. Mill bottom	Drum type mill	H.S. and T.C. cutter	11 and 12 in. cutters
3. Mill valve cover and manifold pads	Duplex milling machines	Stellite cutters	3 to 5 in. cutters
4. Drill base flange, ream locating hole	Multi-spindle drill	H.S. drills	18 holes
6. Rebore cylinder	Multi-spindle boring machine	Stellite cutters	Gage for core shifts
7. Drill 32 holes push rod, etc.	Multi-spindle drill	.....	.....
8. Finish bore cyls.	Vertical boring mach.	Multi-spindle heads	Tolerance 0.002 in.
9. Chamfer cyl. bores	Vertical boring mach.		
10. Drill 87 holes	4-way drill		
12. Tap 78 holes	4-way tapper		

Continued on the next page

the lower flange early in the process as locating points for future operations.

Drum type and rotary table milling machines have become standard equipment, the ability to load and unload without stopping the machine being an attractive feature. Way-drills, for drilling holes in several different faces, are also found in every large motor shop.

The large numbers of holes in a cylinder block give these machines an excellent opportunity to make good. Drill heads, carrying a large number of drills, also have a field where the cost of the way-drill may not be justified.

Methods of machining the cylinder bore vary rather widely. Builder A bores twice, in operations 4 and 38, reams in operation 37, and rough and finish hones in 39, with a repair or correcting operation at the end when necessary.

Builder B has three boring operations: 5, 6 and 7; reams in operation 44 and follows with two honing operations in 45 and 46. Builder C rough bores in operation 6, finish bores in 8; reams in 28 and has two honing operations. Correction of bores is also provided for as a last operation, the cause being the distortion set up by driving cylinder head studs.

In Motor D the cylinders are bored twice, in operations 7 and 8, finish bored in 23, reamed in 42 and honed in 43. Repair or correction is also provided for. In each case there is a realization of the need for good cylinder bores, both as to diameter and finish, although these motors vary rather widely in price.

Inspection

Inspections begin with the rough casting and occur at frequent intervals, not all being listed as operations. Some of the inspections are visual, as the fixtures frequently act as inspection gages. A careful inspection of tools before they go to the job helps to insure parts being machined to size. Cylinder bores are usually inspected for diameter and the variations from standard marked in some way to assist in the selection of the piston that will give the best results. For selective assembly is still considered the most practical method of fitting pistons.

One shop depends on the fixtures and tools to maintain standard sizes. It practically eliminates inspection between operations. But once a day, or more often if deemed necessary, a cylinder block goes into the inspection room to have every important dimension checked in detail. This inspection makes an effective check on tool wear and on the accuracy of fixtures. It also saves a lot of unnecessary inspection between operations.

It will be noted that only builders

Cylinder Blocks—Motor C (Cont.)

No.	Operations Kind	Machine Used	Tools	Remarks
15.	Profile intake parts	Automatic profiler		
16.	Profile conn. rod. clearance	Automatic profiler		
26.	Wash and inspect	Washing machine	Check squareness of bores with joint	
27.	Water test	Fixture for testing		
28.	Finish ream bores	Single spindle drill	.....	Tolerance + or — 0.001 in.
29.	F valve guide holes	Single spindle drill	.....	Tolerance + 0.0005 or — 0.0000 in.
30.	R hone cyl. bores	Multi-spindle hone	.....	Tolerance + 0.0005 — 0.0015 in.
31	F hone cyl. bores	Multi-spindle hone	.....	Tolerance + 0.0015 — 0.0005 in.
32.	Inspect bores	.....	.....	Stamp size for assembly
34.	Stamp valve number	Stamping fixture		
35.	Wash and blow out	Automatic washer		
40.	Re-hone cyl. bores	Single spindle hone	Only for blocks distorted by driving studs	

Cylinder Blocks—Motor D

No.	Operations Kind	Machine Used
1.	R and F top and bottom	Drum type mill
2.	Grind bottom	Rotary table grinder
3.	Drill all bottom holes	Vertical machine and special drill head
4.	Ream locating holes	Vertical drilling machine
6.	Mill manifold face	Drum type mill
7.	1st rough bore	Multi-spindle boring machine
8.	2nd rough bore	Multi-spindle boring, remove 0.031 in.
10.	Drill all top holes	Vertical machine — special drill head
13.	R bore and face valve holes	Multi-spindle drill
15.	Second bore valve holes	Multi-spindle drill
17.	Semi-finish valve holes	Multi-spindle drill
19.	Finish valve holes	Multi-spindle drill
23.	Finish cyl. bore	Multi-spindle boring machine
24.	Chamfer cyl. bore	Vertical boring machine
27.	Drill 12 holes	Multi-spindle drill
28.	Drill 12 holes	Multi-spindle drill
30.	Drill holes for manifold	Vertical machine — special drill head
31.	Tap holes for manifold	Radial drill with double swing. arm
35.	F ream valve guide holes	Vertical drill
36.	Inspect and water test	
37.	Grind top face of block	Rotary table grinder
38	Tap stud holes in top	Tapping machine
40.	Countersink barrel and drive studs	Portable stud driver
41.	Wash and clean	Washing machine
42.	F ream cyl. bores	Vertical spindle machine
43.	F hone cyl. bores	Honing machine
44.	Wash and inspect	Washing machine
45.	Repair when necessary	Re-hone, grind surface, etc.

A and B include crank and cam shaft bearings in the operations. This is due to design, the others using a separate crank case, or engine base casting, which is not included in the cylinder block operations.

Not all of the sheets contain corresponding information. One gives the output per machine per hour, two give the tolerances maintained on some of the operations, while the fourth gives only the name of the operation and the kind of machine used.

High speed cutters are used in all cases where stellite or one of the carbides has not been adopted. It will be noted that, in some cases, it is the practice to combine different kinds of tools in a single operation. Such combinations can frequently be used profitably, taking advantage of the higher speeds possible with the new cutting alloys, by using them for the larger diameters of milling cutters and similar tools.

Individual ideas and initiative are indicated in all these operation sheets which give a general picture of the methods now in use and can be studied to advantage by both motor builders and makers of machine tools.

Saving Time in Planer Work
Discussion

J. T. TOWLSON
London, England

Referring to the article by D. Q. Dunstone under the title given above (*AM*—Vol. 76, page 564) and to the discussion thereon by James C. Harper (Vol. 76, page 1008), I find it rather difficult to decide which of the two methods is the best. Under special circumstances I would favor Mr. Dunstone's method. On the other hand, if it were not for one reason I should back Mr. Harper. A good planer hand, one who can set up his job satisfactorily, is a jewel in any machine shop, but Mr. Harper proposes to reduce him to the rank of an operator by permitting another man to set up his work for him. In my opinion, other things being equal, the quality of the finished product depends upon the way in which the job is set up and secured to the planer table.

In the case of a job going wrong, or springing under the cut, it would be difficult, I think, to know whether to place the blame on the set-up man or on the planer hand. Even under conditions where the planer hand sets up his own job, and the work (possibly a light, straggling casting) springs under pressure of the cut, it is not easy to fix the blame on him. However, if another man is involved (the setter up), the possibility of justly fixing the blame becomes hopeless. Let the man who is responsible for the product set up his own work, and with this in mind I would favor Mr. Dunstone's method.

Some Speed Reduction!

There is a sort of fascination about variable speed devices and few mechanics have not tried a hand at devising something of the kind. Now comes the Link Belt Company with a unit that turns from 0.00594 r.p.m. to 0.000408 r.p.m. The total reduction from the constant speed shaft of the gear to minimum speed of the control screw is 1,840,000 to 1. There is also an automatic time cycle control. This device makes our usual speed reductions seem child's play.

Carbide Cutters for Face Milling

FRANK W. CURTIS
Research Engineer,
Kearney & Trecker Corporation

Speeds and feeds based on three years of research are given for favorable conditions and for limiting factors

TO GET the most out of tungsten carbide for face milling—maximum output per hour with longest cutter life between sharpenings—it is necessary to analyze four factors: (1) the cutter; (2) the work-piece; (3) the fixture; (4) the machine. All have a direct relation to the speed and the feed that can be applied for a given operation.

Since cutting angles for the carbides differ from those used with high-speed steel or Stellite, it is rarely possible that existing cutter bodies can be used. Attempting to assemble a set of carbide blades in a high-speed steel cutter body would be much like hitching a race horse to a plow. The first considerations are a new cutter of modern design with ample strength, direct support to the blades to avoid deflection, and the correct grade of carbide.

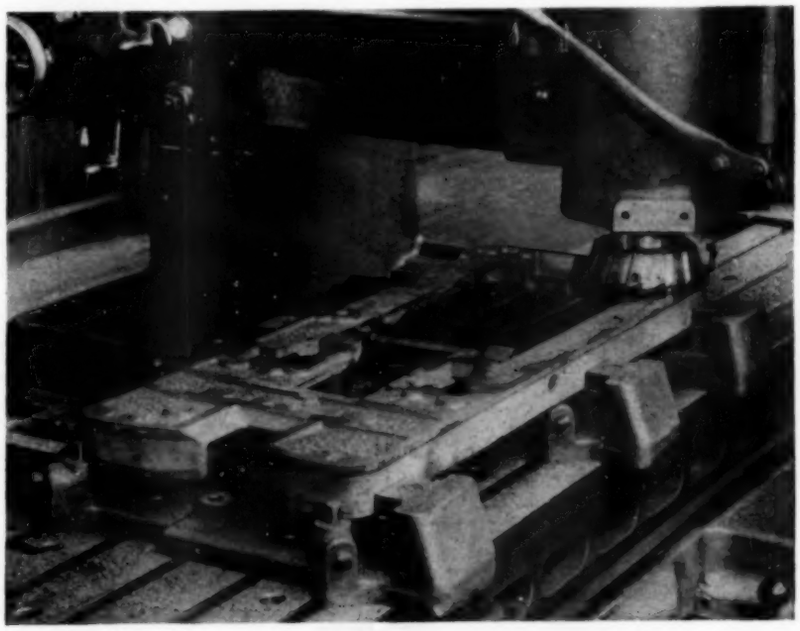
Sometimes the shape of the work-piece is the limiting factor that controls the cutting speed and feed, even though every other condition of the set-up is correct. Frail pieces, for example, often cause difficulty in clamping without distortion so that the desired rigid grip cannot be made. Carbide cutters do not remedy this weakness, nor does any other cutting metal; therefore an allowance must be made from what would be the most efficient rate of metal removal based on the characteristics of the material.

Occasionally a slight change in the design of a part will help to strengthen it, and in the future, more attention will be directed to research in this direction so that light parts will be milled as fast as solid, heavy pieces. Even under present conditions, however, frail parts can be milled satisfactorily, but the increase in speeds and feeds from the use of carbide cutters is merely relative to what is now possible with other cutting metals. The percentage of gain, therefore, will be practically the same as with any other milling operation.

Fixture design is important. The piece to be milled must be held solidly to avoid chatter or vibration. In some cases existing fixtures can be used—if they embody enough strength—but there are many fixtures in use that do not lend themselves to faster milling, and here again an allowance must be made from the estimated peak cutting speeds and feeds. Occasionally a fixture can be strengthened, but usually it is more economical to build a new fixture with the strength needed, together with faster loading features which most old fixtures lack.

We all realize that machines basically designed for carbide operation are the yardsticks for measuring maximum results, but there are many machines in use at this time which cannot be discarded immediately. So we often have to use existing equipment and again make an allowance from what we know to be the best possible performance. This latitude should exclude machines older than five or six years and equipment too light or of insufficient size and power to permit any worthwhile increase. As to size, it is well to check the present power input so as to avoid a possible overload.

From the foregoing it is evident that all four factors are directly dependent upon one another, that collectively they



Although maximum results usually depend on the use of machines especially designed for carbides, profitable increases in speed can often be attained on old equipment

determine what the gain shall be, and that the greater the deviation from the desired requirements, the greater will be the allowance to be made from the best performance.

Fig. 1 shows a chart of cutting speeds for cast iron based on the use of a fixed-bed type milling machine primarily designed for carbide cutters. The speeds are for use with inserted-blade face milling cutters up to 12-in. diameter, since these sizes constitute the majority of cutter requirements at the present time. Larger cutters usually have to be operated at slightly lower speeds.

Three different curves are shown, one for soft iron, the second for medium iron, and the third for hard iron. These are given because the hardness of the iron must be taken into consideration for the carbides just as it is with other cutting materials. For these curves, soft iron is based on a Brinell hardness under 195; medium iron at 195 to 215 Brinell; and hard iron over 215 Brinell, but still under chilled iron which should be considered separately.

A glance at the curves will show that the speeds to be used are in direct relation to the depth of cut; the less metal to be removed the faster the speed, and vice versa. To some extent, these curves tell the major part of the story of carbide milling: Use cast iron as soft as is consistently possible and keep the depth of cut at a minimum.

At the bottom of the chart is shown the proportionate feeds to be used with the speed curves. These are shown in feed per tooth per revolution. The hardness of the material does not alter these feeds, although they do vary in relation to the depth of cut. The feeds are given in teeth per revolution because it is the load a tooth can stand that must be considered; then, too, variations in the number of teeth in cutters make the tooth feed the only logical measure. Cuts deeper than $\frac{3}{8}$ in. have not been considered because at this point speeds and feeds begin to vary broadly according to the diameter of the cutter.

Referring to the chart and assuming that a surface of soft cast iron is to be milled at a depth of $\frac{1}{8}$ in., we find a speed of 300 ft. per minute is recommended, with a feed per tooth per revolution of 0.009 to 0.012 in. If the job requires a cutter 8 in. in diameter, having 20 teeth, and a feed of 1.010 is selected, at 143 r.p.m. (299 ft.), we have $143 \times 20 \times 1.010 =$ a feed of 28.6 in. per minute.

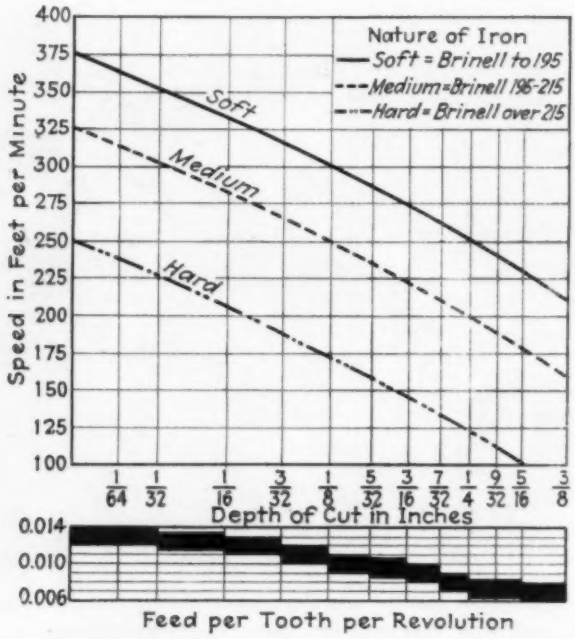
The latitude given in the tooth feed is to compensate for variation in available machine speeds and feeds, as well as to offer a slight fluctuation to compensate for different kinds of set-ups. In other words, if all conditions are known to be ideal, the highest feed per tooth per revolution shown may be used; but if some slight doubt exists, then it will be well to adopt the lowest tooth feed at first.

In Table I is shown a variety of speed and feed combinations based on the chart which will serve for reference purposes.

Having determined the basic speeds and feeds for cast iron, using a modern fixed-bed machine and with all conditions suited to carbide milling, the next step is to consider the reductions to be made with abnormal conditions. There are many, in fact, more than space would permit mentioning; therefore, only the most common conditions that require reductions will be considered. These are shown in Table II. In all cases there is a variation in the allowance to be made, which is necessary because of the difference in existing equipment and in the nature of the set-up. It is usually far better to start at the lowest speed and feed rates and then to increase them gradually until a safe combination has been reached. This would be the point just below where chatter and vibration would set in or where the machine appears to labor excessively.

In rare cases, the maximum speeds and feeds shown in the chart, Fig. 1, may be attained with some existing machines, but these are only possible on light cuts when using small cutters of about 4- or 5-in. diameter. On the other hand, if results are not satisfactory, when the maximum allowances have been made, the set-up apparently is not in the carbide milling field.

In order to analyze these reductions, assume the use of a 6-in. cutter with 14 teeth, for removing $\frac{1}{8}$ in. of soft cast iron. The recommended speed based on a machine basically designed for carbide milling is 300 ft. per minute. The average feed per tooth per revolution is 0.010 in. This would be equal to a table feed of approximately 28 in. per minute. With abnormal condition No. 1, Table II, the speed should be reduced to 210-255 ft., and the feed to 0.008-0.009 in. per tooth per revolution. This would equal a table feed of 15.6-21.4 per minute, or a loss of 23 to 43 per cent



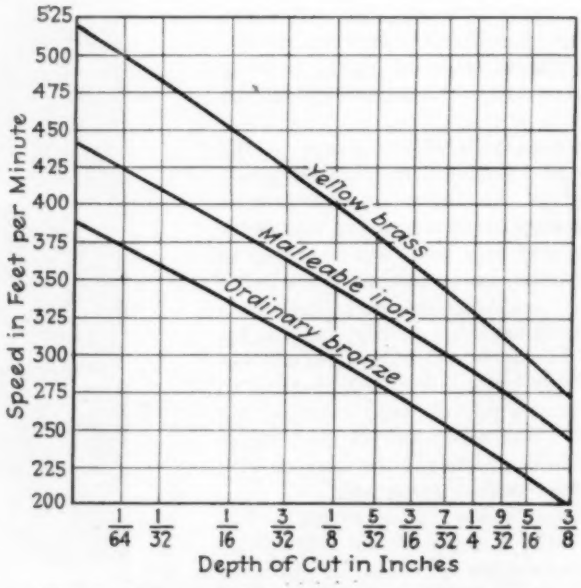


Fig. 1—Speeds and feeds for face milling cast iron with carbide cutters. Fig. 2—Speeds for face milling various metals with carbide cutters

Table I—Cutting speeds and feeds for face milling cast iron with carbide under favorable conditions

Diam.	No. of Teeth	Material	Depth	Speed	R.P.M.	Feed per tooth	Feed per minute
3	8	Soft	3/32	310	395	.011	34.7
4	10	Hard	1/16	210	200	.012	24.0
5	12	Medium	1/4	200	154	.007	12.9
6	14	Hard	1/8	175	112	.010	15.6
7	16	Soft	1/16	275	150	.009	21.6
8	18	Soft	3/32	350	167	.013	39.0
9	20	Medium	3/32	365	112	.011	24.6
10	24	Hard	1/16	210	80	.012	22.0
12	26	Medium	3/32	285	75	.010	19.5

Table II—Reduction in speeds and feeds to be made under adverse conditions

No.	Nature of abnormal condition	Speed, per cent	Feed, per cent
1.	Knee-type machine, not designed for TC milling	15 to 30	10 to 20
2.	Fixed-bed type machine, not designed for TC milling	10 to 20	10 to 20
3.	Poorly designed fixtures, lack of support to workpiece	20 to 40	10 to 20
4.	Difficult workpiece to hold, danger of loosening	15 to 30	25
5.	Frail workpieces, well clamped	10 to 20	25
6.	Chilled spots in workpiece (to protect cutter)	20 to 40	.....
7.	Face of workpiece high above table	10 to 30	25
8.	Machine too light for nature of cut	20 to 50	25
9.	Cutter with excessive overhang of blades	10 to 30	20 to 30
10.	If mirror-like finish is desired	.....	20 to 40

Table III—Feeds to be used with the speeds shown in Fig. 2

Material	Depth of Cut 1/16	3/32	1/8	1/16	1/4
Malleable iron	.011–.013	.010–.012	.009–.011	.008–.019	.006–.008
Brass	.013–.015	.012–.014	.011–.013	.010–.012	.008–.010
Bronze	.013–.015	.012–.014	.011–.013	.010–.012	.008–.010

from that possible with a new machine. These feeds would represent a substantial gain over the performance of high-speed steel. They show not only the gain to be made by merely applying a carbide cutter under existing conditions, but also the possibilities offered by a new machine.

With abnormal conditions Nos. 1 and 2, which represent the use of machines other than those designed for carbide milling, it may also be necessary to make further reductions consisting of any one or more of the allowances shown opposite conditions Nos. 3 to 10. On the other hand, the reductions for conditions Nos. 3 to 10 apply equally to machines basically designed for carbide milling.

A brief study of these conditions will quickly show that it pays to have all conditions as perfect as possible. If, for example, with a new machine it is necessary to reduce the maximum speed from 20 to 40 per cent because of hard spots, surely considerable effort should be made to eliminate this evil, or if the speed must be reduced anywhere from 20 to 40 per cent, and the feed from 10 to 20 per cent because of a poorly designed fixture, steps should be taken to provide a new fixture immediately. The gain to be made would warrant it.

Cutting speeds for other materials that are commonly face milled with carbide are shown in the chart in Fig. 2. These are based on free-cutting metals, and for use with the same range of cutters. Ordinary aluminum, which is not included, can be milled at about three to four times the speeds shown for yellow brass. Aluminum alloys, however, will carry speeds that vary according to their structure, silicon having the most effect on cutting speeds.

With these speeds, the feeds shown in Table III can be applied. These feeds are also given in feed per tooth per revolution. For aluminum, the feeds will be approximately one-half those shown for malleable iron. The allowances to be made from these speeds and feeds for abnormal conditions will closely follow those shown in Table II which are basically intended for the face milling of cast iron.

From the foregoing, it is evident that the use of carbide face milling cutters will be found profitable even when applied under abnormal conditions; that machines basically constructed for carbide operation will permit the largest gains; that attention must be given to all factors that comprise the set-up; that the material to be machined should be uniform and as soft as possible; and, last but not least, that the depth of cut should be as low as is consistent with the shape of the part to be milled.

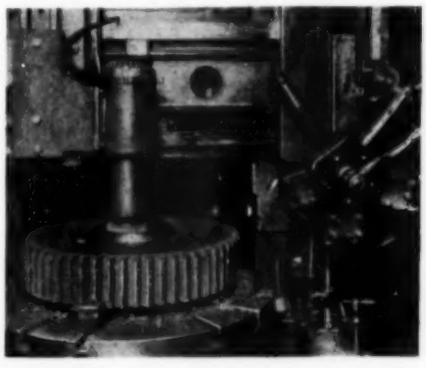
It may also be added that the larger the cutter the greater the need for rigidity. Most milling machines will operate effectively with small cutters, 4 or 5 in. diameter, and many machines with cutters as large as 6 or 7 in., but for larger cutters, there is a greater necessity to have conditions correct.

The recommendations given here are based on carbide milling research conducted over a period of three years, using many different types of milling machines, together with tests conducted in more than fifty plants throughout the country using existing machines and fixtures on actual production operations.

Boring and Grinding at One Setting

FRANCIS A. WESTBROOK

Boring and grinding the bore of a gear at one setting saves time and makes for greater accuracy. The illustration shows such a job in the shop of the Tool Steel Gear & Pinion Company, Cincinnati, Ohio. The hub is bored and faced by the tool head at the right, after which the grinder comes into play. This portable grinder has been mounted on a special, rigid fixture mounted on the left tool slide. The extension support for



the grinding wheel is large and stiff to minimize deflection.

The gear is 30 in. O.D., with a face 7 in. and a hole 8 in. in diameter. The grinding wheel is 6x1 in. Specifications call for a tolerance of 0.005 in. plus or minus (or 0.001 in. total) in diameter, roundness and taper. The operation can be adapted to advantage in many shops or copied where the work is very similar.

Contour Calculations for Forming Tools—XI

O. A. JOHNSON
Chief Tool Designer
Tyson Roller Bearing Company

A comparison of cutting costs between turning with multiple tools and with forming tools indicates the latter's merits

IT IS a fact, recognized by the majority of makers of automatic lathes and screw machines, that their machines are considerably improved by the adoption of forming tools. I shall endeavor to explain in this article what is gained by using forming tools, provided that the tools are properly designed for the most efficient cutting of the particular grade of steel to be machined.

Here are some of the principal reasons for the superiority of forming tools, which will be dealt with in detail:

1. Greater uniformity and precision is obtained than by any method of turning.

Considerable time is gained in:

2. Actual cutting,
3. Set-up of the tools,
4. Sharpening the tools.

The only solution for properly machining some parts lies in the use of forming tools. We shall, however, select a product for illustration, easily machined by turning as well as by forming, and examine the four points mentioned above for both methods of tooling.

In Figs. 82, 83 and 84 is shown a product machined by turning with multiple tooling. Figs. 85 and 86 illustrate the same part machined by forming tools. We will assume that this part is machined from forgings having ⅛-in. stock all around the profile.

The turning method would require four roughing tool bits, four finishing tool bits, one tool bit for forming the radius and one for forming the undercut, making a total of ten different tools. The forming method would require one rough forming tool and one finish forming tool.

Without going into detail, the simplicity of the tooling shown in Figs. 85 and 86 is easily seen. The appearance of the automatic machine using this type of tooling is also improved considerably compared to the tooling shown in Figs. 82, 83 and 84. This statement is substantiated by the photograph of the Sundstrand automatic lathe shown in Article VI.

1. Greater uniformity and precision do not need much explaining after considering the illustrations of the two different methods. When using forming tools, uniformity and precision are controlled by the tool design department and the toolroom. When using turning tools, the entire problem is left up to the operator of the automatic machine, and it is no easy job to turn out uniform precision parts with this kind of tooling on a mass production basis.

2. When calculating the actual cutting time per piece for the turning method, we will have to calculate the cutting time for tools *B*, *C*, *F*, *G* and *K* and add the index time plus the idle time (time required for approaching the work and retreating from the work) to these figures for the final result. We will set the cutting speed at 110 feet at the largest diameter for 4615 steel.

$$\text{Spindle speed} = \frac{110 \times 12}{4.000 \times 3.14} = 105 \quad 100 \text{ r.p.m.}$$

Feed per revolution for tools *B*, *C*, *F* and *G* is 0.015 in. and for tool *K*, 0.002 in.

Cutting time for tool	min.	sec.
$B = \frac{1.5}{0.015 \times 100} =$	1	0
$F =$ same	1	0
$C = \frac{0.875}{0.015 \times 100} =$	0	35
$G =$ same	0	35
$K = \frac{0.125}{0.002 \times 100} =$	0	38
Total actual cutting time	3	48
Index and idle time	0	45
Total time per piece	4	33

While the amount removed with the finish turning tools should be from 0.010 to 0.015 in., it should be from 0.005 to 0.010 in. for the finish forming tool. We will set the feed per revolution for the rough forming tool at 0.003 in. and the finish forming tool at 0.003 in. for the first part of the undercut and 0.0005 in. for the final 0.008 in. We will assume that the forming tools are fed at 45 deg.

	min.	sec.
Cutting time for roughing tool: $\frac{0.125 - 0.008}{0.003 \times 100 \times \cos 45^\circ} =$	0	33
Cutting time for finishing tool: $\frac{0.0625}{0.003 \times 100} = 13$ sec.		
$\frac{0.008}{0.0005 \times 100} = 10$ sec.	0	23
Idle time (approach of roughing retreat of finishing tool)	0	30
Total time per piece	1	26

3. The time required for setting up the tools is, of course, also an important factor. If we consider the two methods, it is an indisputable fact that the tediousness in setting up the tools for the multiple turning method, the time it requires and the unavoidable scrap are far above the forming tool method. Referring to the illustrations in Article X, it is simple and easy to set up a calculated forming tool, and with a little care no scrap is necessary on a single-spindle machine.

4. Considering that the turning method requires ten tools and the forming method only two, the advantages of a forming tool over turning tools, when

This article concludes a series which started in Vol. 76, page 893.

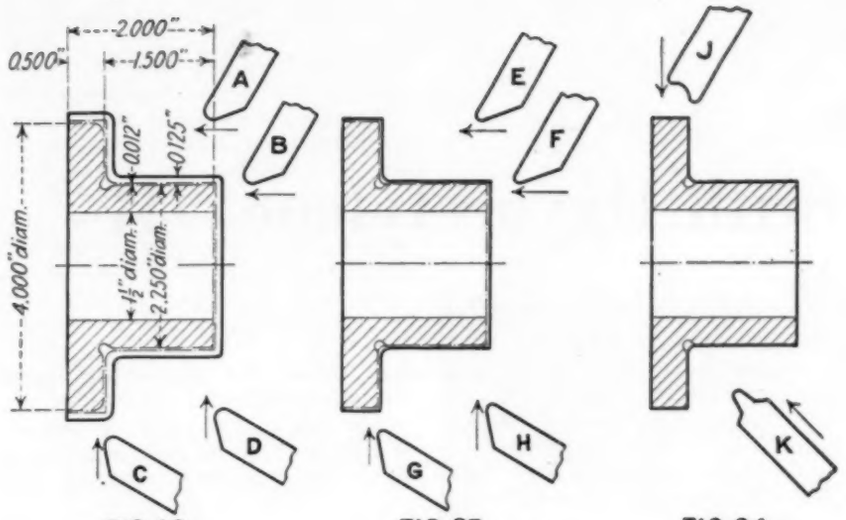


FIG. 82 FIG. 83 FIG. 84

Above—Ten single-operation tools are required to turn the piece illustrated

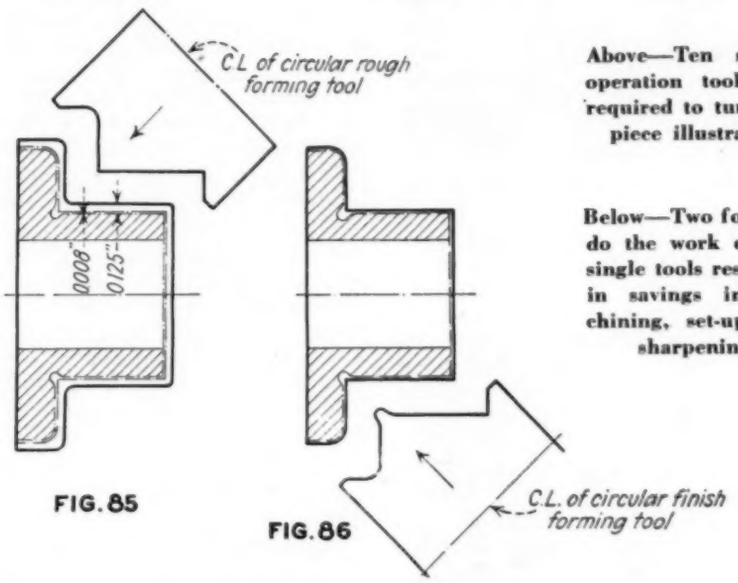


FIG. 85 FIG. 86

Below—Two formers do the work of ten single tools resulting in savings in machining, set-up and sharpening

sharpening is necessary, should easily be recognized. The average operator will always turn out some scrap pieces after sharpening a number of turning tools in adjusting the tools.

The roughing tool shown in Fig. 85 would require sharpening for every 800 pieces for a part of this size, shape and material if the cam feeding the forming tool is properly designed. The finishing tool would under favorable conditions be good for 1,200 pieces. The sharpening of any of these two tools is performed in a tool grinding machine as explained in Article X. The grinding and set-up should not require more than a half hour per tool. The time thus required for sharpening and resetting the forming tools for a quantity of 2,400 pieces would be 3 x ½ hr. for the roughing tool plus 2 x ½ hr. for the finishing tool, a total of 2½ hours or 4.3 per cent of the total time. When considering all the advantages using forming tools, the efficiency would in this case not be less than 90 per cent. For turning tools an efficiency of 85 per cent would be considered as the maximum.

Undoubtedly the question of tool cost will arise before changing over to forming tools. These two forming tools would cost approximately $260 including the engineering. The production for a 10-hour day using turning tools would be 112 pieces at 85 per cent efficiency. For forming tools it would be 377 at 90 per cent efficiency, an increase in production of 265 pieces per day. Grinding away ⅛ in. when sharpening the tool, which is a high figure, the roughing tool would be good for 55 grindings or the production of approximately 44,000 pieces of 166 10-hour days.

The production of 44,000 pieces by the turning method would require 393 days. For the life of the rough forming tool this would mean a saving of 227 days. If we set the operators' wages at $6 per day, we have a saving of $1,382 for the operator alone just computing from the life of the roughing tool. When we remember that only $260 was spent for the forming tools, the superiority of this type of tooling is obvious.

A Flexible Coupling Permitting Free Endwise Flotation
Discussion

HARRY SHAW
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Heywood, Lancashire, England

In an article under the title given above (*AM*—Vol. 76, page 565), J. T. Towlson criticizes the laced-belt coupling, suggesting that having no provision for endwise flotation gives rise to a tendency for the belt to tear at the edges.

As such couplings have given yeoman service under extremely bad conditions from the point of view of shaft alignment and endwise flotation of the shafts, one might be pardoned for wondering why provision for endwise flotation has not been provided for in the manner described by Mr. Towlson. The reason is not difficult to find. The belt will allow either member of the coupling to float endwise considerably more than will ever be necessary, before sufficient endwise pressure will be transmitted through the belt to slide the outer shell *D* of Mr. Towlson's device along the keys.

This is fairly obvious from calculations of torque, pressure on the keys, and the end pressure necessary to overcome the frictional resistance to sliding of the keys. Taking Mr. Towlson's figures for the coupling fitted to a 100-hp. generator-set running at 480 r.p.m. and a coupling of 20 in. in diameter, the torque is approximately 1,300 lb. The total tangential load on the keys is equal to the torque.

Taking the coefficient of friction of steel keys on cast iron under a load of approximately 300 lb. per sq.in. as 0.3, the endwise pressure necessary to slide the outer shell on the keys will be $1{,}300 \times 0.3 = 390$ lb. It is obvious that before the lace belt will transmit this pressure, the necessary endwise float will have taken place, for the action is a catenary one, the pressure necessary to deflect the belt considerably being small.

Mr. Towlson states that the coupling worked successfully. I do not doubt this, but I do doubt whether the shell ever slid on the keys when under load. The device is useful, however, as a means of making endwise adjustment if this is required.

Machining with Oxyacetylene—II

H. H. MOSS
Engineering Department,
The Linde Air Products Company

In the first article (*AM*—Vol. 76, page 1217), flame machining was distinguished from flame cutting. Various applications of the former, described below, suggest a wide field for the development of flame machinery

NOT ALL of the operations classed under "Flame Machining" have been commercialized at the present time. Those which have are so noted as their class is individually discussed. Those grouped under planing, such as deseaming, hogging and surface planing, have all had commercial adaptations, as have some of the milling cuts. The general style of these cuts is shown diagrammatically at *A* and *B*, Fig. 5. Their individual dimensions are the product of combinations of the diameter of cutting oxygen orifice, the cutting oxygen velocity, the rate of travel of the nozzle with respect to the work and the angle of inclination of the nozzle with respect to the surface of the work and to the surface of the cut. All things being equal as to angle of the nozzle, rate of travel and orifice size, the cross-sectional dimensions of these cuts increase with increased oxygen pressure; also the cross-sectional dimensions alter responsively to altered oxygen pressure, provided the conditions of preheat are properly maintained.

The process is being used extensively today for removing cracks or seams in billets, slabs and rounds en route to the various finishing departments of the steel mills and in the steel foundry for exploring and cleaning up cracks and sand holes, removal of superfluous metal in castings caused by defective conditions at the time of pouring and the removal of risers and sprues whose location makes for difficulty in their removal by ordinary line cutting. Other applications under development consist of rough planing either by means of single cuts or by gang assembly of the planing nozzles. Uniformity of flame planed surfaces is approached by overlapping of the cutting oxygen stream or by trailing cuts as illustrated diagrammatically at *D*, *E*, *F* and *G* in Fig. 5. Inasmuch as the tolerance of this type of cutting can be controlled within reasonably close limits, it is not out of order to state that rough surface planing to at least within ¼ to ⅛ in. of finished dimensions is near at hand.

A further development of flame planing, which has been classed under "milling," consists of sinking a planing cut by means of multi-passes of the planing nozzle to produce cuts like those shown at *B*, Fig. 8.

Cuts like these find practical value in the preparation of joint edges for certain types of butt welding as shown in Fig. 6. They can be made either before or after welding. Under this same classification of "Flame Machining" has been included longitudinal fillet cutting, in contradistinction to the customary edge fillet cutting. This is a tangential application which is being developed to provide various fillet contours, as shown diagrammatically in Fig. 7. These cuts find practical value in improving the appearance of the abrupt edges of line cut objects.

Flame turning is next, for it combines both of the previous operations above discussed with a facility which has been shown experimentally to lend itself readily to many lathe turning operations of roughing. The range of this branch is likely to be wide, judging from recent experimental developments on round stock.

The cut at *A*, Fig. 8, is a simple application of tangential cutting under compound lathe motion. It was made by a single pass of the cutting oxygen stream. However, its individual threads or races can be deepened at will by repeating the operation concentrically and by suitable adjustment of the cutting nozzle and the cutting oxygen velocity.

The cuts at *B* and *C* are milling cuts readily produced by multi-pass planing, *B* evidencing general dimensions and *C*

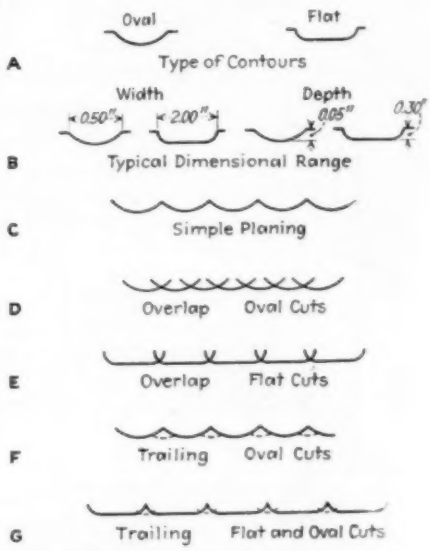


Fig. 5—Styles of planing and turning flame cuts are shown diagrammatically

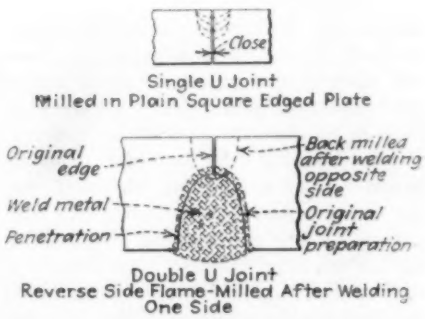


Fig. 6—Flame cuts may be used preliminary to welding

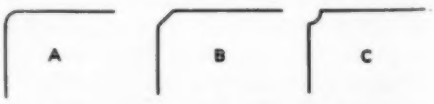


Fig. 7—Longitudinal fillet cutting improves appearance by eliminating rough edges. *A*—round; *B*—square; *C*—concave

The second of two articles based on a paper presented before the American Welding Society at Buffalo, October 3, 1932.

the degree of control which can be maintained.

Cut *D* indicates a range of single pass cutting produced by a compound angle setting of the cutting gas stream. For cuts of this type, the axis of the cutting nozzle is made tangent to both the surface of the stock being cut and the desired vertical face of the cut to be made. Such cuts are started by first milling a slot similar to *B* as shown dotted in *D* which provides opportunity to apply the compound setting against either wall of the milled slot.

Effect of Temperature

Cut *E* is merely a modification of *D*, illustrating roughly the flexibility of flame turning. In this case, the contour of the cut has been changed by means of a rotating action applied to the cutting nozzle while the work is rotating to provide uncut material to the nozzle. From these experiments it was obvious that, having suitably sensitive and flexible mountings for the cutting devices and feeds, any desired profile could be produced. It was a further observation that the responsiveness of the material to the cutting operation was, in a large measure, proportional to the temperature of the material in the region immediate to the cutting zone. In other words, contour, uniformity and flexibility of flame machining are closely allied to the temperature of the work and improve as the temperature increases.

Under the classification, "Flame Drilling," fall two developments of flame machining which promise to render valuable service in the way of producing holes for various purposes. Flame punching, now under development, seeks to bore a relatively straight hole by the principle of a single concentric cutting operation. Large size nozzles and reasonably high pressures are required, and while efforts to date in this direction have not produced an entirely satisfactory bore, the results have nevertheless been encouraging and indicate that a practical alignment tolerance will likely be attained.

A form of flame punching which has recently been somewhat commercialized and which makes a close approach to the full parallel punch is the flame centering of solid round billets in preparation for the piercing operation in the manufacture of seamless tubing.

The subdivision, "Lance," under flame drilling does not refer to major oxygen lance operations which are covered by the subdivision under manual gas cutting. Instead, it covers the use of a miniature lance to bore a long concentric hole through a piece of stock for the purpose of clearing a channel for subsequent flame boring. The operation

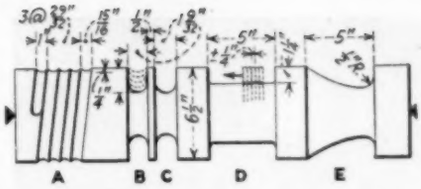
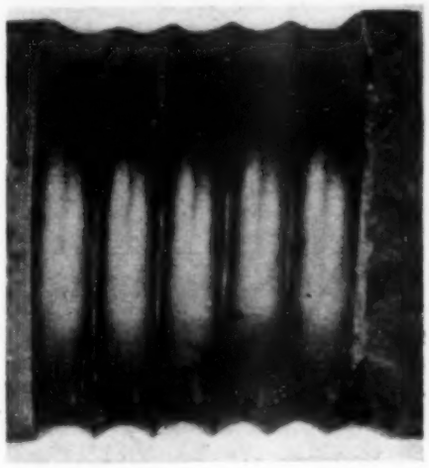


Fig. 8—Flame machining of various types are indicated on the above piece



This screw thread cut was made as indicated in Fig. 8, *A*, by a single pass of the flame

Actual cuts made by multi-pass planing as shown at Fig. 8, *B* and *C*

is not unlike that of the major lance except that it utilizes light carbon burning types of blowpipe handles fitted with suitable lengths of small diameter black iron tubing. The device is capable of producing relatively uniform holes of considerable depth.

The final classification has been entitled "Flame Boring." It is one which is altogether experimental to date but possesses practical aspects for general boring operations. Fundamentally, it consists of a modification of the operation resulting from the compound setting of the cutting nozzle which produced the deep single pass cut shown at *D*, Fig. 8. Only in this classification it is applied to an internal annular surface, and promises to remove the metal at rates comparable with that of the flame turning operation.

To the "Flame Machining" group has been added "Precision Cutting," which classification, as previously explained, was made because of the precise uniformity which has been developed in recent line cutting experiments seeking the lower limit of cutting tolerances. As brought out by J. R. Dawson in a paper presented before the New York Section of the American Welding Society in October, 1931, precision cutting to within a few thousandths of an inch was obtained in 1¼ in. thick plate through careful set-up of standard cutting apparatus. These experiments have thrown considerable light upon normal or line cutting and have confirmed the belief that many milling operations such as those applied in the structural field will, in the not too far distant future, be entirely feasible by this means.

Dawson gave two illustrations of this work, one showing a precision cut on flame milled bar bent through 150 deg. without evidence of fracture or any cracks in the flame cut edge; another showing a 1¼-in. low carbon steel plate recut to within $\frac{1}{16}$ in. of the first flame cut, the alignment and squareness of the cut edge being equal to that of the original cut. These particular cuts were true as to squareness and alignment to within 0.01 of an inch.

Rate of Cut

The rate of tangential cutting in terms of pounds of metal removed per hour varies with different types of cuts. As yet there does not seem to be any simple formula or criteria for predetermining this data. For the simple type of cut shown at *A*, Fig. 8, the rate varied between 500 to 600 lb. of base metal per hr., which could doubtlessly have been considerably increased judging from the responsiveness obtained during these experiments. Cuts like those shown at *B* and *C*, Fig. 8, were made at rates of 450 to 550 lb. per hr.; whereas for the cut *D*, the rate varied between 1,200 to 1,800 lb. per hr. From the standpoint of comparison with tool machining, the rate of volumetric displacement in making the cut illustrated at *D* with high-speed steel cutting tools would probably be in the neighborhood of 550 to 650 lb. per hr. for soft steel, 250 to 350 lb. per hr. for medium steel and 115 to 160 lb. per hr. for hard steel. These volumetric displacements are obtained with cuts ⅜ in. in depth, with 0.0625 in. feed and surface speeds averaging 130, 65 and 30 ft. per min. respectively.

In the simple planing operations,

rates varied between 500 to 1,000 lb. per hr. with single nozzles. With the aid of compound nozzle operations, there would seem to be no limit to the possibility for increased removal rates.

Just where these rates will ultimately settle is hard to determine at this time. It has been indicated, however, that for any particular cut by flame machining, there will be a corresponding set of cutting conditions involving velocity of the cutting oxygen stream, proximity and angle of inclination of the stream, rate of nozzle travel and feed that will give the most satisfactory results as to lead or workability, cleanliness of slag-blow and economy of labor and gases. In other words, there will be definite practical limits for each combination beyond which the operation becomes either too critical or totally uncontrollable for practical objects.

The oxygen expense of tangential cutting varies also with the different types of cuts, but compared with that of normal or line cutting is considerably less. There are two reasons advanced to account for this: (1) likelihood of more base metal removed in the molten state, and (2) greater degree of surface impingement of the cutting oxygen stream.

Over the range of mechanical flame machining performed to date the oxygen expense has varied between 2 to 2¾ cu.ft. per lb. of metal removed and with indications of still further oxygen economy as more experience is gained. For any set of constant conditions as to the size of the cutting oxygen orifice, angle and proximity of cutting nozzle and rate of travel of nozzle with respect to the work, the oxygen expense varies almost directly as the volume of metal removed per cut, that is, the volumetric displacement increases with increased oxygen pressure for the same size cutting oxygen orifice, all other things being equal. This relationship is shown in Fig. 9. It is also true that for every set of conditions, as just noted, there is an intermediate range of pressures wherein the machining results are satisfactory as to regularity and cleanliness, and beyond which the conditions become critical, resulting in irregularities and other unsatisfactory conditions.

Preheating Advantageous

With preheated stock, the oxygen expense will doubtless be reduced well below the figures of 2 to 2¾ cu.ft., above mentioned; at the same time, the responsiveness of the work to the machining flame or flames should be rendered considerably more sensitive. Preheat should, in addition, both narrow the cutting tolerances and make for closer control of the cutting action.

Round solid billets are centered with oxyacetylene

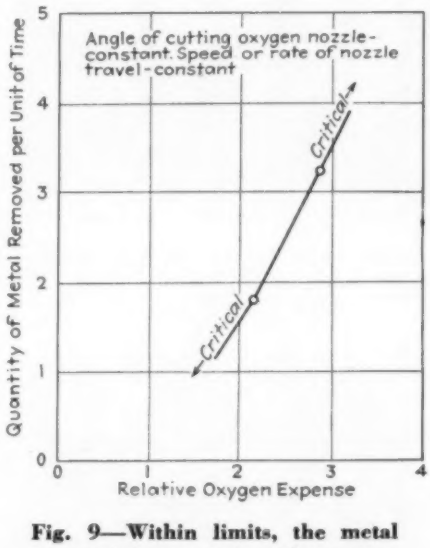


Fig. 9—Within limits, the metal removed is approximately proportional to the oxygen consumed

From the metallurgical standpoint, preheating performs another valuable service in flame machining, namely, that of retarding the rate of cooling of the base metal which has been heated in the region of the cut to beyond its critical temperature. Quenching from this point in the temperature scale, which can be retarded by suitable preheat, produces increased hardness in proportion to the carbon content and makes subsequent machining operations difficult.

Another advantage of preheat is that it prevents the development of unequal stresses in the part being machined, the action being one of compensating for or otherwise subordinating those which concurrently form behind the cutting operation.

It has been observed that the harder steels, or those having the higher amounts of combined carbon, responded more readily to the action of flame-machining operations than those of low combined carbon, such as the low carbon steels, indicating that the economy of flame machining of carbon steels will improve as the hardness of the base metal increases.

When it is considered that power is needed only for turning the stock and none for performing the cut, as the operation of flame machining is fully free turning, there would seem to be many opportunities to effect economies by machining by this new method, especially with the harder steels. Each operation is more or less a problem unto itself, calling for a coordination of nozzle tooling and metallurgical control to produce a result satisfactory for the subsequent shaping and final tool finishing or grinding of the part in question.

While the commercial range of the flame cutting is by far the most extensively developed at present, that of the flame machining is tending to become equally as broad and none the less valuable as a formative tool for the preparation and shaping of the carbon steels. Its rate of progress aside from the operations of deseaming or desurfacing and rough flame hogging will, to a large extent, be proportional to the degree of precision commercially obtainable by the machining nozzle. The conjecture suggests a rather important development of flame tooling similar to that which attended the development of modern machine tools a decade or so ago.

Angles in Degrees and Decimals

WILLIAM H. KELLOGG

The division of the circle into 360 degrees has a logical foundation in practice for the reason that an inscribed square or hexagon can be easily described as being an integral number of degrees. On the other hand, the division of the degree itself has no practical reason for being expressed in 60ths (minutes) or 3,600ths (seconds), and such practice should be discontinued in favor of decimals.

In calculating divisions of the circle for use in designing mechanisms, the writer has found it most convenient to give the results in degrees and decimals thereof, both for recording the measurement and for reading for further calculations. There are many calculations in the working out of the actions of some mechanisms in which the result of dividing the circle gives an angle in very odd fractions of degrees that could very well be expressed in decimals carried to two or three places, but which are recorded in degrees, minutes and seconds.

How much simpler it is, for example, in showing the angle of a sector of a circle divided into eleven equal parts, to say 32.727 deg. instead of saying 32 deg., 43 min., 38 seconds.

EDITORIALS

AMERICAN MACHINIST
VOLUME 77 ESTABLISHED 1877 NUMBER 1
McGRAW-HILL PUBLISHING COMPANY, INC.
K. H. CONDIT F. H. COLVIN
EDITORS

1933—Plus or Minus?

Will 1933 business be equal to that of 1932? This question, asked by one of our machinery friends, stumped us. At the same time it pointed to the need of evaluating the unknown factors of the future in terms of recent experience.

Most pressing of all these factors is the debt factor. The Lausanne agreement wiped out reparations. The flurry of debt payments and defaults in mid-December probably cleared the way somewhat for a reasonable readjustment in these obligations. Private debts only remain to be considered.

The feeling is growing that 1933 will be the year of the write-offs, which means that the wise creditor will find the way to compromise with his debtor so that he, the creditor, gets the most out of what otherwise might be a total loss. What profit is there, for instance, in foreclosing a farm mortgage and evicting the debtor if the forecloser can neither dispose of the property nor operate it to produce enough income to pay the taxes and the interest on what small investment remains? Adjustments are even now in process in the West. The sooner they are completed the sooner will the farmer regain his purchasing power, with all that that means to manufacturing and employment. Much the same reasoning can be applied to city buildings and suburban homes.

A rise in the prices of everything we consume would answer much the same purpose as a domestic debt write-off, but such an occurrence seems rather remote just now. On the other hand, price rises start apparently without warning and often run to impressive improvement. It may well be that before the year is over we shall have secured relief from a combination of debt write-offs and rising prices, neither going far enough alone to do the job, but accomplishing it together.

Politically, there is little to be expected. When either political party takes control with such a landslide as occurred in November it is inevitable that many mediocre candidates will be carried into office. Industry must not anticipate very much from the committee chairmen who will take over Congressional responsibilities. Prohibition is definitely on the way out, but how much revenue can be raised from beer or something stronger remains to be seen.

All in all, help from political quarters does not rank with the constructive factors of 1933. But there are other factors that can be counted on. Fundamentally there is the new conception of the importance of the producing employee as a consumer. This idea has grown up since the war and marks a change in the old capitalistic attitude of employer to employee that is revolutionary. It is spreading rapidly and unquestionably has done much to help us through our recent difficulties. Backed by even a small measure of financial recovery this modern attitude will carry the country to new heights of well-being, heights reared from a sound foundation of mutual interest, understanding and respect.

Coupled with this philosophy must be a grim determination by industry and business to regain their own feet despite the delays and obstructions of politics. Such a determination is now manifesting itself in the work of the Industrial Rehabilitation and Spread-the-Work Committees. Their efforts will continue and will be supplemented by individuals who have the will to survive and who will be the leaders in the next upward surge.

The year of 1933 has its share of trouble for all of us, without a doubt, but it also holds much of promise for those who have the courage to face facts realistically and to adapt themselves to changing conditions. As for us, we are budgeting for the first quarter only—because we think the second quarter will have to be budgeted on a higher level.

Is This Management?

Something over ten years ago the Hoover Committee on Waste in Industry made a splendid report. It is generally understood that the original conclusions were that about 75 per cent of waste in industry could be attributed to management. This was however toned down to 50 per cent in the final report. The two instances that follow indicate that the original estimate was the more accurate.

The big mogul of a company whose headquarters are on the Pacific Coast came East recently to look over the field. He found a customer with a legitimate reason for dissatisfaction, though not to an alarming degree. But to impress the customer with his importance he called up the factory in California and bawled them out from the customer's plant. The phone charges were $65—on a $200 order.

In a similar case the head of a "combine" spent $200 in phone calls from Florida to the plant of one of his subsidiaries trying to induce the manager to take an order from a friend of his—at a loss. The manager stuck to his guns and avoided the loss. But the $200 phone toll was charged to his plant.

This same "big boss" watches production costs and

pay rolls with an eagle eye, but $200 toll charges in calls that never should have been made, disturbs him not at all. Instances like this make one feel that the original estimate was none too high.

Volume 77

With this first number of 1933 *American Machinist* begins its seventy-seventh volume, differing from most of its predecessors in that the bi-weekly numbers for the full year will be included within it. The old rule of two volumes each year was broken in 1932 when the paper was changed from a weekly to a bi-weekly publication.

The editorial staff charged with producing *American Machinist* in 1933 includes KENNETH H. CONDIT and FRED H. COLVIN, editors; S. ASHTON HAND and JOHN HAYDOCK, associate editors; and H. R. LEGRAND, assistant editor. Contributing editors and regional representatives include CHESTER B. LORD, New York; PAUL WOOTON, Washington; JOHN SHAVER, Cleveland, C. B. GORDY, Detroit.

Founded in 1877, *American Machinist* has maintained its name and identity ever since, changing only its frequency of publication as the needs of the field dictated.

• CHIPS •

Holidays over, industry faces a new year chastened but hopeful . . . with the lame duck Congress in its last struggle, with a kilowatt-hour dollar and like expedients proposed, wise heads bide their time, not asking too much from the first quarter . . . But low inventories, long deferred replacement, and American impatience at going without are seen as factors that will be felt before 1933 has passed into history.

Sales tax and beer bill get temporary setbacks . . . the former through President-elect's apparent disapproval . . . the latter through the Senate's liking for doing things its own way . . . An extra session after March 4 now seems a certainty . . . Roosevelt makes economy plans and seeks blanket authority to pare appropriation bills . . . would cut veterans' costs and Federal payroll . . . Senate appoints subcommittee for hearings on 5-day week, 6-hour day for American labor . . . House passes bill for Philippine self-rule . . . provides for independence of islands in ten years if conditions are met.

Franco-American commercial treaty appears sidetracked as aftermath of debt default . . . some claim that French action will be helpful in speeding final settlement . . . Meanwhile France lends Austria $13,800,000 . . . U. S. experts sail for Geneva to help prepare agenda for the World Economic Conference . . . currency stabilization and trade barriers are the chief issues.

Sensing waning popularity Soviet leaders turn toward production for consumers for 1933 . . . grant concessions to grain-raising groups . . . Australian government experiment in state-operated implement plan proves failure . . . Independent manufacturers supply better product at lower cost . . . Japan has a change of heart and sends back the popular Debuchi . . . places orders for American machine tools running into six figures . . . Accustomed to autocracy, Germany accepts the strong hand of Von Schleicher and approves his policies . . . Insull goes free as Greece refuses extradition . . . says Athen's atmosphere better than Chicago's.

Federal bond prices reach peak as year closes . . . Forty railroad reports show upward swing . . . gross revenue responds to improvement in carloadings . . . November is the first month to better 1931 figures . . . But roads join in plea for continuance of increased rates . . . Wage agreement continued in force for another year . . . Patrick J. Farrell elected Interstate Commerce Commission chairman . . . Steel activity recedes but less than expected . . . Automobile demand keeps decline to only 1 point . . . R.F.C. cuts interest rate half of 1 per cent . . . promises more liberal policy.

American Association for the Advancement of Science and the Econometric Society hold joint annual meeting . . . Gerard Swope presents 9-point program for broad organization of industry . . . Walter Rautenstrauch delivers "message of technocracy" and starts an argument . . . Kettering of General Motors says we have nothing to fear from the machine . . . Dean Kimball asserts that the machine age is slowing down in accordance with the law of diminishing returns . . . National Industrial Conference Board declares job insurance a failure . . . points to European experience.

Machine tool dealers modify Chicago plan to meet Federal Trade Commission objections . . . Virgil Jordan leaves McGraw-Hill to head National Industrial Conference Board . . . Hendey Machine Company elects Ayr president . . . Coonley selected to lead American Standards Association during 1933.

Bethlehem gets cruiser contract on low bid . . . Railroads report 3 locomotives, 2,398 freight cars on order as against 10 and 4,252 last year . . . Electric energy output continues relatively high, all things considered . . . Carloadings aided by heavy coal shipments . . . Commodity prices generally are not holding up well . . . General situation is unquestionably better than at the end of 1931.

Chicago Plan Modified to Overcome Objections

A "cease and desist" order issued by the Federal Trade Commission on September 29 (*AM*—Vol. 76, page 1164c) has been met by a modification of the so-called "Chicago" plan against which it was directed. The commission has accepted the report on the revised plan as compliance with its order with the understanding that at the end of a year's time a study will be made of the manner of operation.

Proponents of the Chicago plan claim that it has corrected some of the oldest evils in the machinery business. Among these is the pitting of one supplier against another especially in regard to turn-ins on old equipment which were formerly used to secure destructive price concessions. To remedy this and other practices which had resulted in demoralizing the industry, members operating under the Chicago plan agreed to post bids for old machines offered as part payment for new equipment. This information but not the bidders name was made available to other members. The bidder making the first or highest appraisal further agreed to accept the old equipment at the price quoted regardless whether he or another supplier received the order for the new equipment.

This arrangement was adjudged to be illegal by the Federal Trade Commission insofar as it eliminated competitive bidding by its members. It was apparent, however, that some features of the plan were beneficial and desirable. Accordingly a revision was undertaken to remove the objectionable elements of the plan while retaining those which were proper.

The modified plan retains the registration of bids formerly employed but distinguishes between "firm offers" and "allowances." The member making the bid has the option of choosing between these two forms. If he makes a firm offer he becomes obligated to accept the traded in machine whether he gets the new machine order or not, as under the old plan. If he makes an allowance he does not agree to take the old machine unless he receives an order for the new.

Courses of Study Open to Unemployed Engineers

Under the auspices of the engineering societies and the colleges in the New York metropolitan area, courses in engineering, economics and business are offered this winter and spring. The engineering courses will be conducted by volunteer or unemployed teachers under the supervision of members of the faculty of Columbia University, New York University, Stevens Institute of Technology and Polytechnic Institute of Brooklyn.

There will be no charge for this instruction. Classes will be held in rooms made available in the Engineering Societies building. Six courses will be offered in the following subjects: (1) Business Finance, (2) Sales Engineering, (3) Power Plant Engineering, (4) Structures and Mechanical Equipment of Buildings, (5) Industrial Applications of Electricity, (6) Industrial Management.

Courses will be given in the forenoons beginning January 9 and continuing for twenty weeks. Requests for application should be addressed to P. H. Littlefield, manager, The Engineering Foundation, 29 West 39th St., New York City.

Date of S.A.E. Dinner Changed

Although previously announced for Thursday, the annual banquet of the Society of Automotive Engineers will be held on Wednesday, January 11 at the Hotel Pennsylvania during the week of the New York automobile show. C. F. Kettering, director of research, General Motors Corporation, will be the toastmaster.

The speakers will be Bancroft Gherardi, vice-president of the American Telephone & Telegraph Co., and Roy Faulkner, president of the Pierce-Arrow Sales Corporation.

Regnald Werrenrath, baritone, will sing, and Rube Goldberg, cartoonist, will give a talk.

Ayr Becomes Hendey President

On January 2, David Ayr, formerly of the Pratt & Whitney Co., assumed the presidency of the Hendey Machine Co. of Torrington, Conn. He succeeds

John A. Coe who resigned to become chairman of the board of the same company.

Mr. Ayr received his early training at the Brown & Sharpe Co. and was later connected with the Pierce Arrow Motor Car Co. He then became general superintendent of the Guerney Ball Bearing Co. During the World War, Mr. Ayr was active in the manufacture of muni-

• INDUSTRIAL REVIEW •

Statements of machinery builders and distributors in the principal industrial centers of the country indicate little expectation of much business improvement during the first quarter of 1933. The machine tool people, in particular, are not expecting many orders until general business recovers to a much greater extent.

Disappointment over the shortcomings of the lame duck Congress is manifest. Machinery men, like other practical business men, realize to the full how important some definite action toward balancing the budget is under present conditions. They are therefore going to have little patience with a do-nothing attitude on the part of Congress, and they are going to be equally critical of the new administration if it does not show a willingness to face realities, quickly and courageously. This attitude shows through most of the statements received.

The principal exception to the general feeling that things are going to drag for the first three months comes from Detroit. There the automobile builders are actually expecting that the new models will attract enough popular approval to lead to active manufacturing, for at least a few months. Elsewhere there is a practical resolve to go after what little business there is and make the most of it.

tions in the United States and Canada as works manager of the Russell Motor Car Co. He left that position to join the Pratt & Whitney Co., first as works manager and later as manager of the machinery division and member of the board of directors. Mr. Ayr is widely known in industrial circles.

New England Rehabilitation Projects Now at $2,613,000

Industrial rehabilitation in New England shows encouraging progress with a total of $2,613,000 in expenditures pledged.

Two new members of the Vermont Committee on Industrial Rehabilitation are reported by Ralph E. Flanders, chairman. These are Elias Robertson, president of the Brattleboro Chamber of Commerce and A. N. Lyons, vice-president of the Howe Scale Co. A profitable joint meeting was held with leaders of the share-the-work movement.

Charles W. Potter, president of The Potter Press, has accepted the chairmanship of the Massachusetts Rehabilitation Committee. Frank W. Bistrup, secretary of the industrial department of the Associated Industries of Massachusetts, is acting as Rehabilitation secretary.

E. C. Mayo, chairman of the Rhode Island committee, has been working with vice-chairman Henry D. Sharpe with the idea of combining the activities of the rehabilitation and share-the-work movements.

In the Bridgeport district these two movements are being carried along jointly by the following committee: Col. Leonard S. Horner, vice-president of the Bullard Co.; Robert M. Eames, general manager of the Bryant Electric Co.; H. Almon Chaffee, vice-president of the A. W. Burrett Co.; W. G. Carey, Jr., president of the Yale & Towne Mfg. Co.; and George S. Hawley, president of the Bridgeport Gas Light Co.

The following industrial concerns in Bridgeport have pledged $129,800 toward rehabilitation work: Acme Shear Co., Bassick Co., Bryant Electric Co. The grand total of twenty Bridgeport industrial companies to date is $382,100 and the total including commercial concerns is $715,082.

For New Haven the grand total is $587,300 for 28 firms. W. E. Malley Co. will spend $44,000 for improvements and rearrangement of equipment. Among the metal-working concerns helping to make up this total are the New Haven Clock Co., Atlantic Wire Co., Sargent & Co., and W. F. Gilbert Co.

The Hartford Electric Co. will spend $448,000 for industrial rehabilitation during 1933. In addition this concern has an extra appropriation of $40,000 for capital expenditure as a part of the program over and above that needed to keep their own men employed. The work is on underground conduits on which only men at present unemployed will be used.

John H. Goss, vice-president of the Scovil Mfg. Co. and Connecticut Rehabilitation chairman, organized the Waterbury district. Clifford F. Hollister, treasurer of the American Brass Co. has been made chairman of the Waterbury committee. Mr. Goss also started a zone organization in the district covered by Meriden, Middletown, and Wallingford with the appointment of C. R. Gardiner, president of the International Silver Co., as zone chairman.

Coonley Elected President of Standards Association

HOWARD COONLEY, president of the Walworth Co., has been selected to head the American Standards Association for the year 1933. Other officers elected are F. E. MOSKOVICS, chairman of the board of the Marmon-Herrington Co., vice-president; CLOYD M. CHAPMAN, consulting engineer, United Engineers and Constructors, chairman of the Standards Council; and J. C. IRWIN, valuation engineer, Boston and Albany Railroad, vice-chairman of the Standards Council.

Both Mr. Coonley and Mr. Moskovics are members of the A.S.A. board of directors. Mr. Coonley's membership dates from 1928 when he was chosen to represent the A.S.M.E., and Mr. Moskovics' membership from 1929 when he became representative of the S.A.E.

Mr. Coonley began his business career with Walter Baker & Co. in 1900. He became vice-president of the Coonley Manufacturing Co. in 1902 and president in 1908. Since 1913 he has been president of the Walworth Co. During the World War, he was vice-president of the United States Shipping Board Emergency Fleet Corporation.

Mr. Moskovics, long prominent in the automotive industry, began his business career with Daimler in Europe. Later he was with the Continental Tire Co. and partner in the firm of Brandenburg Bros. In 1907 he became manager of the Kingston Motor Car Co. and later sales manager of the Remy Electric Co. He then became vice-president of the Nordyke & Marmon Co., in 1924, vice-president of the Franklin Automobile Co., and 1925, president of the Stutz Motor Co. In 1929 he resigned to assume presidency of the Improved Products Corporation.

HOWARD COONLEY

F. E. MOSKOVICS

Job Insurance Declared a Failure

Based on a study of unemployment insurance in Germany, the National Industrial Conference Board has issued a report that contends that depression unemployment is not an actuarial risk. This prevents putting the plan on a sound financial basis and has resulted in the collapse of the German system.

The report further states that "there is no reason to believe that the experience of the United States would be different" were a similar system adopted here. It claims that during the first three and a half years of its existence ending in March, 1931, the German employment insurance fund suffered a total excess of expenditure over income of $364,900,000. Despite a program of rigid economy the collapse of the plan came in June, 1932, ending one of the world's greatest social experiments.

Bank Credit to Industry Inadequate Conference Board Finds

"Viewed from the standpoint of banking and financial statistics, it is patent that the course of the present depression has been made deeper by the failure of the banking system at large to extend adequate credit accommodation to industry and trade as a whole." So states a report submitted by the research staff of the National Industrial Conference Board as a result of a study made at the invitation of members of the Banking and Industrial Committee of the New York Federal Reserve District. The investigation was based on an analysis of confidential replies from about 3500 concerns chiefly manufacturing establishments, to a questionnaire as to their recent bank credit experiences.

Explanation of the failure to meet legitimate demands for credit on the part of industry and business is found mainly in the significant changes in the role of banks in financing production and exchange in the seven-year period preceding economic recession. During this time bank credit came more and more to be made available to business indirectly through security, fixed assets, and consumer loans rather than direct commercial loans. Another explanation lies in the structure of the banking system with its thousands of independently operating banks variously organized under national and state charters with materially different standards of practice but all interdependent in the end.

The effect of these conditions was to impart to a large section of business independence from banks as debtors and to make banking stability hinge more largely on the stability of property and security values. When these values became unstable, banks as going institutions were rendered vulnerable to the caprices of public confidence. Efforts by banks to improve their positions by readjusting their assets, when banking failures became numerous and public confidence wavered, led first to the restriction of credit advanced directly to business and later of credit advanced indirectly through their own investments, loans on securities, loans on real estate, and loans to consumers. Credit restriction led to a further loss of confidence and set in motion a vicious sequence of financial catastrophe.

This assembling and analysis of factual material naturally leads to an inquiry as to the most effective steps to take in a reorganization of the American banking system looking to the prevention of similar financial collapses in the future. The report, in a chapter on the problem of bank credit reconstruction, states that the re-establishment of credit contacts between banks and their business customers would seem to be the most critical issue in the restoration of conditions under which bank credit may again be made readily accessible to industry and trade.

In view of the fact that the majority of the complaints of bank credit difficulties come from the smaller concerns, the Conference Board states that the question may well be raised whether special measures should not be taken to assist small concerns in solving their working capital problems, which involve the extension of seasonal credits and credits of intermediate terms or terms longer than those permitted by the requirements of sound commercial banking practice. Since banks no longer look with favor on such loans, according to indications noted in the study, and since in strict banking theory they should not widely extend such loans, is there not a real defect in the American banking system because of the absence of specialized banking institutions dealing with this sort of credit, with resources for lending acquired from deposits on a savings or time basis? Should not such institutions be created in response to the exigencies of the present emergency by banking and industrial enterprise? If legislative authorization is needed, should not the attention of the Congress and the state legislatures be directed to this need? If no other method of organization seems feasible, should not the Federal Government establish an intermediate-term-credit system for industry and commerce as it has for agriculture?

The study points out in conclusion that the complex and interrelated problems affecting the American banking system, on which divergent opinions are held by bankers and financial experts, are none the less significant to business because of their complexity. It is incumbent on industry and trade to cooperate fully in the whole problem of bank-credit reconstruction, both the immediate and the long-run problem, in order that the entire financial structure of business may be properly balanced.

Exports of Machinery During November, 1932

	Nov., 1932	Oct., 1932	Nov., 1931
Electrical machinery	$3,697,630	$3,889,807	$5,677,646
Power-generating machinery (except electric and automotive)	329,705	296,712	525,256
Construction machinery	175,658	259,874	466,792
Mining, well and pumping equipment	706,731	741,580	818,078
Power-driven, metal-working machinery	1,579,478	1,382,429	2,244,018
Other metal-working machinery	113,067	98,943	199,353
Textile machinery	286,684	297,733	516,204

Exports of Metal-Working Machinery During November, 1932

	Nov., 1932	Oct., 1932	Nov., 1931
Engine lathes	$111,061	$40,964	$84,777
Turret lathes	22,581	6,149	18,463
Other lathes	102,508	57,932	143,443
Vertical boring mills and chucking machines	50,516	9,740	5,193
Thread cutting, automatic screw machines	14,399	49,991	51,845
Knee and column type milling machines	48,243	58,392	21,939
Other milling machines	120,904	138,381	76,196
Gear cutting machines	67,556	148,074	17,002
Vertical drilling machines	60,785	2,032	27,750
Radial drilling machines	36,938	48,239	1,600
Other drilling machines	95,414	124,790	29,805
Planers and shapers	10,815	24,405	59,152
Surface grinding machines	2,850	8,410	18,733
External cylindrical grinding machines	5,958	78,169	100,562
Internal grinding machines	77,429	24,921	35,376
Tool grinding, cutter grinding and universal grinding	32,470	24,132	35,777
Other metal grinding machines	150,312	68,376	62,445
Sheet and plate metal working machines	349,926	153,638	613,973
Forging machinery	28,352	35,565	368,455
Rolling mill machinery	17,616	48,681	101,183
Foundry and molding equipment	32,403	23,966	21,101
Other power-driven metal-working machinery and parts	140,442	207,462	349,348

Other Metal-Working Machinery

Pneumatic portable tools	$17,803	$25,646	$36,067
Other portable hand-operated machines	20,575	21,356	28,200
Chucks for machines	2,673	3,939	5,107
Machine-operated pipe and thread cutters, stocks, dies, taps and other machine-operated cutting tools	41,193	26,266	63,875
Other metal-working machine tools	30,823	21,736	66,104

McGraw-Hill Economist To Head Conference Board

VIRGIL JORDAN, for the past three years economist of the McGraw-Hill Publishing Co. and a member of the editorial staff of the *Business Week*, has been designated president of the National Industrial Conference Board to succeed the late Magnus Alexander. Mr. Jordan served as director of research of the board from 1920 to 1929 and returns to it now to inaugurate a new program of activity. He will take up his new duties early in the year.

The industrial conference board was established in 1916 as a fact-finding agency for industry. Composed of 91 business executives and representatives of national and state industrial organizations it provides a forum for the discussion of business problems.

Mr. Jordan will continue in a consulting capacity for the McGraw-Hill Publishing Co. and the *Business Week*.

• BUSINESS ITEMS •

Simmons Machine Tool Corp. has moved its New York sales office to its recently opened warehouse at the mouth of the Holland Tunnel, 214 Provost St., Jersey City, N. J. A. J. WEISBECKER is district sales manager. Headquarters of the company remain at Albany, N. Y.

Hardinge Bros., Inc., and the Morrison Machine Products, Inc., Elmira, N. Y., have appointed RAY H. MORRIS as factory representative in the Connecticut territory.

Reorganization of the Cleveland Hardware Co., forgings manufacturer, has resulted in the Cleveland Hardware & Forging Co., with the principal executives remaining. T. P. ROBINSON, former president and treasurer, holds similar positions, as does CHARLES E. ADAMS, chairman. A. J. SANFORD, former sales manager of the Timken Steel & Tubes Co., has been elected vice-president, secretary and general manager.

Fire destroyed the major portion of the plant and equipment of the J. C. Stine Foundry & Machine Co., Tyrone, Pa., Dec. 17, with a loss of more than $140,000. The company manufactures a general line of pumps and mining machinery.

The Van Norman Machine Tool Co., Springfield, Mass., has announced that its line of duplex milling machines, oscillating and plunge cut grinders, as well as special production equipment will be handled in the Detroit territory by the Charles A. Strelinger Co., 149 Larned St., E., Detroit.

• PERSONALS •

WALTER C. ALLEN, president for 17 years of the Yale & Towne Mfg. Co., succeeds as chairman SCHUYLER MERRITT, Representative-elect to Congress, who has resigned after being an executive of the firm for 50 years. W. GIBSON CAREY, JR., vice-president and treasurer, has been elected president and remains as treasurer.

WALTER GEIST of the Allis-Chalmers Mfg. Co., returned recently from a three months' trip to Europe, visiting the principal countries on the Continent and England. Mr. Geist reports that the trend in these countries is toward the use of individual motor drives.

MARTIN L. OLSON, for many years an instructor of drafting in the Hyde Park High School, Boston, Mass., has been promoted to acting director-coordinator in charge of the cooperative industrial department of the school.

EDWARD L. RYERSON, JR., president of Joseph T. Ryerson & Son, and president of the joint emergency relief fund, Chicago, was awarded the Rosenberger medal by the University of Chicago for "achievement deemed of great benefit to humanity."

F. C. WILLIAM, formerly connected with the Lycoming Motor Corp., Williamsport, Pa., has been elected president of the Horseheads Engineering & Machine Co., Horseheads, N. Y.

WINTHROP WITHINGTON, vice-president and manufacturing director of the American Fork & Hoe Co., Cleveland, is now chief of the Cleveland Ordnance District of the United States Army Ordnance Reserve. He succeeds HENRY C. OSBORN, of the Addressograph-Multigraph Corp.

• OBITUARIES •

E. M. HERR, vice-chairman of the Westinghouse Electric & Mfg. Co., died in New York, Dec. 24, after a long illness. Mr. Herr gave up active direction of the company in 1929 after being president for 18 years. After graduating from Sheffield Scientific School of Yale University, in 1884, he spent ten years in railroad work. He then became general manager of the Westinghouse Air Brake Co., and in 1905 was elected first vice-president of the Westinghouse Electric & Mfg. Co. He was appointed receiver and general manager of the company in 1907, and in 1911 was chosen president. During his incumbency the company grew to be one of the important manufacturing concerns of the world.

CHESTER A. LASELL, president of the Whitin Machine Works, Whitinsville, Mass., died Dec. 16.

FREDERICK M. PERRY, 56, head of the firm of John W. Perry & Sons, boiler manufacturers, died in Syracuse, N. Y., Dec. 23.

JAMES TURNER, for 10 years mechanical engineer for the Nicholson File Co., Providence, R. I., died Dec. 24. While engineer at the Nicholson File Co. he made a number of improvements on file manufacturing machinery.

• MEETINGS •

AMERICAN ENGINEERING COUNCIL. Annual meeting. January 15, 1933. Washington Hotel, Washington, D. C. L. W. WALLACE, secretary, 744 Jackson Place, Washington, D. C.

AMERICAN MANAGEMENT ASSOCIATION. Annual meeting of the personnel division. February 7-8. Palmer House, Chicago. JOHN G. GOETZ, managing director, 20 Vesey St., New York, N. Y.

GRAY IRON INSTITUTE. General meeting. January 26. Congress Hotel, Chicago. Gray Iron Institute, Cleveland, Ohio.

NATIONAL ALLIANCE OF ART AND INDUSTRY. Exhibition of new materials, new products and new uses. January 16 to February 15. National Alliance of Art and Industry, 65 East 56th St., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual dinner, Wednesday, January 11, Hotel Pennsylvania, New York. Annual meeting. January 23-26. Book-Cadillac Hotel, Detroit. JOHN A. C. WARNER, secretary. 29 West 39th St., New York.

THE ROUND TABLE

Corporation or Partnership?

"Al, I used to think you were a pretty good business man, but now I'm not so sure."

"I used to think so myself, Ed, but I'm not so sure either. But why bring that up?"

"Well, if you were a good business man, you would incorporate your business."

"What would be the advantage?"

"In the first place, you would be involved only for the amount of the stock you owned. As it is, you're responsible not only for half the debts, but for Mason's debts also."

"Oh no, I'm not, only for those contracted in the firm name."

"It's just the same. If he commits the firm and can't pay, or won't pay, you are responsible for the whole thing."

"Surely, but there are thousands of partnerships where that doesn't happen. I'm not afraid that Mason won't pay his debts. Any other advantages in incorporating?"

"Yes, lots. If you incorporate, you'll increase the prestige of your business."

"I'm not worrying about prestige. If two people are honest, a partnership is the best kind of a business organization. You can do as you like without a lot of legal restrictions. You are just as free as an individual owner."

"Yes, but with this difference. If you should die, the partnership would be automatically dissolved. If it were sold at auction your family would get about 10 per cent of its real value, because much of the good will would die with you. Your wife could not go into partnership with Mason except at a disadvantage, because she could not carry half the responsibility as you do,"

"Yes, but corporations have the disadvantages of high state and federal taxes. They must make frequent reports as to condition, and are bothered by state supervision and a whole raft of regulations. Some corporations have surrendered their charters and gone back to partnerships."

"Another thing, Al. When you want to borrow money you have to assume the risk for both yourself and Mason. If you were incorporated you could put up some of your stock for security instead of risking your home every time."

"There must be something behind the stock, Ed, before you can get a loan. A partnership can get a loan a good deal quicker than a corporation of the same size."

"Why should it?"

"Just for the reasons you've been giving. The bank knows that both are responsible for the full amount of the note, and it also figures that if two men are willing to go into partnership together they must both be honest. Not only that, they must be efficient because they are not afraid to risk everything on the outcome of their partnership,"

"Well, talking to you is like talking loans to a banker with no security in sight. You don't get anywhere."

Are there any advantages in incorporating a small manufacturing business? Do the restrictions offset the advantages?

Discussion

No Mistakes

We should have just two classes of employees, highly skilled men who would earn $50 per week and more, and apprentices preparing for these jobs. The figures work out something as follows:

	Highly skilled man	Ordinary machinist
Value of product per hour	$4.50	$2.00
Normal overhead per hour	1.25	1.75
Spoiled work	0.01	0.20
Paid to worker	1.50	0.50
Profit	1.74	Loss 0.45

The large plant can put the ordinary machinist on planned operations, so that even with an increased overhead it can make a profit from his work, but such detailed organization is impossible in the small plant which does a variety of work.

We can easily figure that the highly skilled man is the cheapest for the small shop, but it is a difficult thing to find the man. Today it is easier to get 100 ordinary machinists at $15 per week than one who can earn $50. That is one reason I am so much interested in apprenticeship. The smaller plants, in particular, need these highly skilled men, and the only way to get them is to train them. But there is no demand for this kind of training from the boys.

—A. W. Forbes,
Forbes & Myers.

Taking Chances

It has been my experience, not only with patents but with almost everything else, that written agreements are good only for lawyer fodder. Even if you write a check, the simplest possible agreement, and want to get out of it,

your lawyer will prove you were *non compos mentis* for that particular moment and sane all the rest of your life.

If two former friends become estranged and resort to lawyers, their friendship is gone for life. If there are no lawyers, they get to thinking things over and by and by go back and shake hands and start all over again.

—E. H. Fish.

Some years ago a certain man organized a religious society and continued as its leader for many years. During this time, he copyrighted in his own name the ideas which were developed and for which he was largely responsible. This was not questioned as his integrity was above suspicion and as it was evident that he took such action for the protection of the society.

After his death, it was discovered that he had made no provision for the ownership of the copyrights. Consequently, his heirs served notice on the society to buy the copyrights or discontinue their use. As these were fundamental, it was necessary to comply with the demands of the heirs.

It is easy to see a parallel in the case of a man who holds patents which are vital in the operation of a concern. While one may have absolute confidence in him, it is dangerous to let this extend to his heirs who will probably be unacquainted with conditions and oral agreements and who are quite likely to take action which they honestly believe is within their moral rights. Unquestionably this man should at least make some written agreement which will protect other members of the firm in the event of disagreement or death.

—Harrison G. Brown,
Supervisor of Standards,
Crompton & Knowles Loom Works.

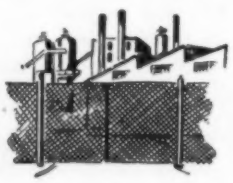
Branching Out

The question of taking up a new line is probably the greatest invisible enemy industry as a whole has to contend with today. With the drastic reduction in sales, the small manufacturer especially is prone to spend most of his time and energy looking for something that the other fellow may be manufacturing with apparent success. He does not seem to realize or thoughtfully to analyze that the product, which may seem to have untold possibilities, has been the result of years of the most careful research together with an extensive sales campaign; on the other hand, he may not even give the slightest attention to the fact that the underlying reason for the wide demand for the particular article may be due to a personal contact with the trade. All of these things are not evident upon the surface, but those who break into a new field, which is foreign to their general line, will soon find them out.

The reason I am confining myself to the small manufacturer is based upon facts. For instance, the manufacturer with limited means cannot afford to investigate scientifically the ultimate demand for any new device while the large producer has available a vast sales force, which at a moment's notice, can be instructed to gather information on the sales possibility of any proposed new venture. It is, therefore, obvious that the man without these facilities is just gambling while the other knows exactly what he is doing and will not engage in the enterprise unless facts conclusively prove that it will be a profitable undertaking.

—Harold L. Wynn,
Executive Engineer,
Pacific Electric Mfg. Corporation.

Most of us are candid enough to admit that the business we operate, whatever it may be, is for the purpose of making money. A business that is making no money, or that is running into the red, is a little like a man that is stuck in a quicksand and slowly sinking. When a



man is sinking in a quicksand and a boy comes running with a board, the man is unlikely to tell him to go away, because he wants a full-grown man to bring the board.

Now, the way I see it, it is possible that this little air valve might prove to be a board. If the jobber mentioned (whom we assume to be well-established and reputable) estimates that he will sell 2,000 the first year, it would seem to be a ceditable proposition.

Assuming that their rotary compressor is going to go over with a bang and that both Mason and Al will be kept busy, it probably would be unwise to cumber themselves with valve manufacture for a while. But until that point is definitely and thoroughly established, it is a mark of wisdom to get a few of their eggs into another basket. There is the possibility this valve may eventually be adopted as standard equipment by other compressor manufacturers, and there is even the chance that it may eventually be the chief product. It depends, of course, upon the valve, and upon the method and degree of consistency with which it is advertised. —John E. Hyler.

Divided Responsibility

It looks as though Al had gotten off on the wrong foot, as Ed suggests, by not letting Tucker make the whole compressor. Many automobiles have been built from parts made by different manufacturers, but in every case I know of the complete part is made in one plant. They buy a certain make of motor, a complete transmission, rear axle and other parts, but they seldom buy them piecemeal and fit one man's parts into another unit. We talk of interchangeability, but if we really know manufacturing to close tolerances, we all have mental reservations about the actual parts going together as well as they do on the drawing board.

Unit assemblies generally fit their mating parts at one or two points only. But when it comes to buying spiral bevel pinions of one man and the ring gear of another, you are asking for trouble. And you usually get it.

Better have the whole machine—or at least a complete unit, made by Tucker next time, Al.

—C. F. Herbert.

Books and Bosses

Can it be possible that the once aggressive Al has become a spineless yes-man?

Certainly in this matter of costs he is right in sticking to the idea that a bookkeeping system of even the most elementary kind is essential to the successful conduct of even a one-man business. Until an adequate cost system is instituted, Al and his partner are going to be two worried business men.

So I would suggest that at this early stage in their business career Al and his friend Mason "go to the mat" on this important question. If it is approached in a proper light a sensible decision is bound to be the outcome. Should they persist in the attitude of bending over backward in an effort to be agreeable, some day in the near future a white document with an official seal is going to adorn the front door of their shop.

I have in mind a similar partnership. One of the partners is easy going though an excellent mechanic. The other's technical equipment is indifferent, but he handles the cost situation admirably. When they first started, Ed, the easy going one, would throw in an extra half hour's labor or omit to charge a customer for a small part. Jim, the other half of the concern, bore it in silence for a little while, and then one day, they had a "showdown" which almost dissolved the partnership, but they came out of it with increased respect for one another and with a clearer understanding. —Robert S. Alexander.

American Machinist
Reference Book Sheet

Abbreviations for Scientific and Engineering Terms

THE American Standards Association gave approval in November, 1932, to a tentative standard known as "Abbreviations for Scientific and Engineering Terms." Sponsors for the standard were: American Association for the Advancement of Science; American Institute of Electrical Engineers; American Society of Civil Engineers; Society for the Promotion of Engineering Education; The American Society of Mechanical Engineers. Periods after abbreviations have been omitted for economy and to avoid the confusion that results when there are employed in the same text the abbreviations for names of metric units without periods and the abbreviations for names of English units with periods. There are necessary exceptions.

Absolute	abs
Acre	acre
Acre-foot	acre-ft
Air horsepower	air hp
Alternating-current (as adjective)	a-c
Ampere	amp
Ampere-hour	amp-hr
Angstrom unit	A
Antilogarithm	antilog
Atomic weight	at. wt
Atmosphere	atm
Average	avg
Avoirdupois	avdp
Barometer	bar.
Barrel	bbl
Baumé	Bé
Board feet (feet board measure)	fbm
Boiler pressure	bp
Boiling point	bp
Brake horsepower	bhp
Brake horsepower-hour	bhp-hr
Brinell hardness number	Bhn
British thermal unit	Btu or B†
Bushel	bu
Calory	car
Candle	c
Candlepower	cp
Center to center	c to c
Centigram	cg
Centiliter	cl
Centimeter	cm
Centimeter-gram-second (system)	cgs
Cent	c or ¢
Chemical	chem
Chemically pure	cp
Circular	cir
Circular mils	cir mils
Coefficient	coef
Cologarithm	colog
Concentrate	conc
Conductivity	cond
Constant	const
Continental horsepower	cont hp
Cord	cd
Cosecant	csc
Cosine	cos
Cost, insurance, and freight	cif
Cotangent	ctn
Coulomb	spell out
Counter electromotive force	counter emf
Cubic	cu
Cubic centimeter	cu cm., cm^3, cc (liquid, meaning milliliter, ml)
Cubic foot	cu ft
Cubic feet per second	cfs
Cubic inch	cu in.
Cubic meter	cu m or m^3
Cubic micron	cu μ or cu mu or μ^3
Cubic millimeter	cu mm or mm^3
Cubic yard	cu yd
Current density	spell out
Cylinder	cyl
Day	spell out
Decibel	db
Degree*	deg or °
Degree Centigrade	C
Degree Fahrenheit	F
Degree Kelvin	K
Degree Réaumur	R
Diameter	diam
Direct-current (as adjective)	d-c
Dollar	$
Dozen	doz
Dram	dr
Efficiency	eff
Electric	elec
Electromotive force	emf
Elevation	el
Engine	eng
Engineer	engr
Engineering	engg
Equation	eq
External	ext
Farad	spell out
Feet board measure (board feet)	fbm
Feet per minute	fpm
Feet per second	fps
Fluid	fl
Foot	ft
Foot-candle	ft-c
Foot-Lambert	ft-L
Foot-pound	ft-lb
Foot-pound-second (system)	fps
Franc	fr
Free aboard ship	spell out
Free alongside ship	spell out
Free on board	f.o.b.
Freezing point	fp
Frequency	spell out
Furlong	fur.
Fusion point	fnp
Gallon	gal
Gallons per minute	gpm
Gallons per second	gps
Grain	spell out
Gram	g
Gram-calory	g-cal
Greatest common divisor	gcd
Hectare	ha
Henry	h
High-pressure (adjective)	h-p
Hogshead	hhd
Horsepower	hp
Horsepower-hour	hp-hr
Hour	hr
Hundred	C
Hundredweight (112 lb.)	cwt
Hyperbolic sine	sinh
Hyperbolic cosine	cosh
Hyperbolic tangent	tanh
Inch	in.
Inch-pound	in-lb
Inches per second	ips
Indicated horsepower	ihp
Indicated horsepower-hour	ihp-hr
Intermediate-pressure (adjective)	i-p
Internal	int
Joule	j
Kilocycle	kc
Kilogram	kg
Kilogram-meter	kg-m

† Abbreviation recommended by the A.S.M.E. Main Committee on Power Test Codes

B = 1 Btu
kB = 1000 Btu
MB = 1,000,000 Btu

* In general the sign ° is used where space conditions make it necessary, as in tabular matter, and when abbreviations are cumbersome, as in some angular measurements; i.e., 59° 23′ 42″. In the interest of simplicity and clarity the Committee has recommended that the abbreviation for the temperature scale, F, C, K, etc., always be included in expressions for numerical temperatures.

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Abbreviations for Scientific and Engineering Terms

(Continued)

Kilograms per cubic meter	kg per cu m or kg/m³
Kilograms per second	kgps
Kiloliter	kl
Kilometer	km
Kilometers per second	kmps
Kilovar (reactive kilovolt-ampere)	kvar
Kilovarhour (reactive kilovolt-ampere-hour)	kvarh
Kilovolt	kv
Kilovolt-ampere	kva
Kilowatt	kw
Kilowatthour	kwhr
Lambert	L
Latitude	lat
Least common multiple	lcm
Linear foot	lin ft
Lira	spell out
Liter	l
Liquid	liq
Logarithm (common)	log
Logarithm (natural)	log e or ln
Longitude	long.
Low-pressure (as adjective)	l-p
Lumen	l
Lumen-hour	l-hr
Lumens per watt	lpw
Magnetomotive force	mmf
Mark (German coinage)	M.
Mass	spell out
Mathematics (ical)	math
Maximum	max
Mean effective pressure	mep
Mean horizontal candlepower	mhcp
Megohm	spell out
Melting point	mp
Meter	m
Meter-kilogram	m-kg
Mho	spell out
Microampere	μa or mu a
Microfarad	μf or mu f
Micromicron	$\mu\mu$ or mu mu
Micron	μ mu
Microwatt	μw or mu w
Mile	spell out
Miles per hour	mph
Miles per hour per second	mphps
Milliampere	ma
Millifarad	mf
Milligram	mg
Millihenry	mh
Millilambert	mL
Milliliter	ml
Millimeter	mm
Millimicron	mμ or m mu
Million	spell out
Million gallons per day	mgd
Millivolt	mv
Minimum	min
Minute	min
Minute (angular measure)	′
Molecular weight	mol. wt
Mol	spell out
Month	spell out
National Electric Code	NEC
Ohm	spell out
Ohm-centimeter	ohm-cm
Ounce	oz
Ounce-foot	oz-ft
Ounce-inch	oz-in
Parts per million	ppm
Peck	pk
Penny (Pence)	d
Pennyweight	dwt
Peso	spell out
Pint	pt
Potential	spell out
Potential difference	spell out
Pound	lb
Pound-foot	lb-ft
Pound-inch	lb-in.
Pounds per brake horsepower-hour	lb per bhp-hr
Pounds per square foot	lb per sq ft
Pounds per square inch	lb per sq in.
Pound sterling	£
Power factor	spell out
Quart	qt
Radian	spell out
Reactive kilovolt-ampere	rkva
Reactive volt-ampere	rva
Revolutions per minute	rpm
Revolutions per second	rps
Rod	spell out
Root mean square	rms
Round	rd
Secant	sec
Second	sec
Second (angular measure)	″
Second-foot (see cubic feet per second)	
Shaft horsepower	shp
Shilling	s
Sine	sin
Specific gravity	sp gr
Specific heat	sp ht
Spherical candle power	scp
Square	sq
Square centimeter	sq cm or cm²
Square foot	sq ft
Square inch	sq in.
Square kilometer	sq km or km²
Square meter	sq m or m²
Square micron	sq μ or sq mu or μ^2
Square millimeter	sq mm or mm²
Square root of mean square	rms
Standard	std
Stere	s
Tangent	tan
Temperature	temp
Tensile strength	ts
Thousand	M
Ton	spell out
Ton-mile	spell out
Twaddell	Twad
Var (reactive volt-ampere)	var
Versed sine	vers
Volt	v
Volt-ampere	va
Volt-coulomb	spell out
Watt	w
Watthour	whr
Watts per candle	wpc
Week	spell out
Weight	wt
Yard	yd
Year	yr

Appendix

Alternative abbreviations conforming to the practice of the International Electrotechnical Commission

Ampere	A
Ampere-hour	Ah
Coulomb	C
Farad	F
Henry	H
Joule	J
Kilovolt	kV
Kilovolt-ampere	kVA
Kilowatt	kW
Kilowatthour	kWh
Megawatt	MW
Megohm	MΩ
Microampere	μ A
Microfarad	μ F
Microwatt	μ W
Milliampere	mA
Millifarad	mF
Millihenry	mH
Millivolt	mV
Ohm	Ω
Volt	V
Volt-ampere	VA
Volt-coulomb	VC
Watt	W
Watthour	Wh

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Patents and How They Are Procured

KARL FENNING

Patent Attorney and Professor of Patent Law, Georgetown University

Many engineers and shop men have a feeling that some day they may make an invention that will bring them a fortune. In preparation for that happy day let us see what the patent laws can do for us

THE PURPOSE of the patent system is to procure for the public information on new improved devices and operations. A patent is a monopoly, and it is the only monopoly which our form of government believes is desirable. It is not a monopoly in the sense that the owner of the patent takes away from the public something which the public already had. If you gave a monopoly to a man to sell playing cards, for instance, you would take away from a great many people a right which they already have, but when a man makes an invention, he produces something that is entirely new and which the public might never have but for his activity in inventing it. In order to prevail upon him to disclose his invention to the public rather than to keep it secret, the government says that it will give to him for a limited period a monopoly on the thing that he has produced. In order to get the monopoly, he must make such disclosures as will make it possible at the end of the period for other individuals to employ his invention.

The machinery by which this is accomplished is provided by the patent statutes. To that machinery have been added the rules of practice of the patent office, and of course, in the 140 years that the patent system has been in existence, a good many court decisions have fixed much of the details of procedure.

The statute definitely says that the inventor must file the application for patent. The Constitution says that the right may be given to the inventor. That means that a person cannot get a patent unless he himself is the inventor. The application must be filed by the inventor himself, but the inventor may assign that application, when once filed, to whomever he wishes. The patent actually issues to the assignee who then actually owns the invention.

A patent application at the present time consists of three papers, the formal petition addressed to the Commissioner of Patents, in which the inventor identifies himself, says he has made an invention and would like a patent on it. What is technically referred to as the specification, accompanied by drawings, is a careful description of the invention indicating what it is, its purpose, and then in detail a review of the particular things necessary to carry out that invention.

Since it is likewise essential for the public to know what portion can be used while the monopoly is alive, the specification is accompanied by a set of claims. Each of these claims sets out briefly the particular phase of the new invention on which the inventor wishes a monopoly. The specification itself is a description which goes to the public after the monopoly. The claims simply define that monopoly. If the inventor has described in his specification ten things and in his claims only nine, that tenth thing presumably he dedicates to the public and the public is free, even during the monopoly, to use that part of the invention. Then follows the oath in which the inventor swears that he is the inventor and that the invention has not been in public use. If a man makes an invention and uses it for upwards of two years publicly, the presumption is that he does not want a patent on it so that when he goes to file his application he must swear that he has not used it publicly for the two-year period.

Many difficulties have arisen in deciding just who is the inventor. When a man works privately in his home or in his laboratory, it is easy enough to say that he is the inventor, but when he has assistants, employees or associates working with him, it may be difficult to determine who made the invention. One of the difficulties therefore with the patent system at the present time is that the patent fails to protect the inventor because someone else has made a mistake in applying for the patent. This most frequently happens when a man makes an invention and goes to someone in the early stages and asks for money to start the invention going. Under such circumstances it is not all uncommon for the inventor and the man who puts up the money to agree that they both will apply for the patent. That makes the patent no good at all.

The application having been filed, the function of the patent office is to issue the patent, but it must first determine whether the patent may properly be issued. Examination of the application consists of two parts: first, to see that it is in proper form; second, to see that there is an invention involved, that is, to see that there is some consideration to be given to the public eventually for the monopoly granted. The patent office is divided into 63 divisions, each division consisting of a chief and several assistants, and each division is assigned certain specific types of inventions. In each of these divisions, each assistant is a specialist and such specialists do the actual work of examining and determining whether a patent should issue.

The only way an examiner can be sure he is granting a patent which is for something new is for him to have before him all of the old matter. The statute provides that the Commissioner of Patents shall have also a classification division made up of practical men whose function it is to go over our patents, foreign patents and literature. But here is one of the important defects of the patent system at the present time. Because of false economies for many years, the patent office has not been provided with funds to carry out this classification. The result is that the

United States patents are not properly classified, and in foreign patents, the classification is extremely poor.

An application while it is pending in the patent office is kept secret, the theory being that the inventor makes the offer only under consideration that he receive a patent. He gets no right by filing the application except what is known as a technical reduction to practice. That is, it has the same effect as if he had actually built a machine and operated a machine. If he put the words "Patent applied for" or "Patent pending" on what he makes, it has no legal standing whatever and is merely a gratuitous notice to the public.

The patent system has another serious defect in that the information which the public wants, which is the whole foundation of the patent system, is not properly distributed. There are many things lying in the patent office which have been patented that nobody knows about which the inventor has not used commercially during the patent period of 17 years. If there were some way of collecting that information each year and showing the things now available for public use, the government would be doing much towards carrying out the real purposes of the patent system.

A notice of allowance is not a patent issue but merely states that the patent office is satisfied that the patent should be granted. Within six months of that time the applicant must pay an additional fee for actual issuance of the patent.

Patent Delays

One of the causes for delay in the patent office is the so-called "interference procedure." Of the 70,000 or 80,000 patent applications filed every year there are some 3,000 to 4,000 inventions involved, the right to which is claimed by two or more individuals. If two applications are pending, obviously they cannot both have a patent, and the statute provides that the patent is to be issued to the first inventor. An interference is declared between these two inventors. Each is allowed to file an affidavit in the office as to when he made his invention and how he proceeded with it. After that, he has opportunity to be heard in the patent office before an examiner of interference who determines on the evidence before him which he thinks is the first inventor.

There are two provisions for correcting issued patents under the statute, the provision for disclaimers which provides that if a man through error or mistake has claimed more than his invention, he may come into the patent office and disclaim part of the invention. If a man has by error, accident or mistake claimed more than he should or has made some error in his application, he may apply for a re-issue which contemplates a new application entirely.

The patent office does not deal with any questions of infringement whatever. Infringement is a question for the United State's District Court after the patent issues. If it is an equity suit, the chief purpose is that the man wants not damages for what his opponent has done but he wants to get him out of the way or stop competing with him. Therefore, he wants an injunction and the general final termination of an equity suit is either a dismissal of the bill or the granting of an injunction against continuing infringement. From the District Court an appeal goes to the Circuit Court of Appeals. There are ten of these Circuit Court of Appeals, and it sometimes happens that a patent is sustained in one court while the patent is found invalid in another. It has been suggested that there should be a single court of patent appeals in the United States instead of going to these ten circuits. A single patent court would decide all cases.

Johnson Tries Chrome Plated Tools

JOHN R. GODFREY

"It's funny, Godfrey, how old notions pop up after a long spell, and how they often work the second or third time because conditions have changed. We get brand new materials and methods and the difficulties we experienced years ago melt away when the metallurgist or the chemist get on the job." It was old man Johnson waxing enthusiastic, as he does sometimes.

"Dad is thinking of some chromium plating we've been trying, Uncle John," explained Tom. "We've had some rather interesting results, too. Tell him about them, Dad."

"Tom's right, Godfrey, we've had some eye-openers lately. You remember how we used to hate recut files when we were in the shop? Once in a while the boss would try to save money by having the old files sand blasted, and they seldom were worth the price. Then a mysterious guy came along with a new process and the old man fell for that, too. He just dropped the old files in acid and ate away enough metal to sharpen the file tooth points up a bit. But they didn't last as well as the sand blasted files. So you can guess that I wasn't enthusiastic when Tom wanted to try this new stunt of chromium plating. But it's worked out fairly well in most cases. The files work fine on such stuff as Bakelite, dural and brass. They do very well on cast iron. When it comes to steel it's a toss up.

"Tom has been trying it on all sorts of tools and some of them last so long I'm sorry for the steel makers. Twist drills have been a howling success, both from the hard cutting edge and because the chips slide up the groove as though it was greased. Chrome is funny stuff that way, Godfrey, it's harder than most anything I know of and yet it's 'slick' or slippery. Chips slide off it and don't dig holes just back of the cutting edge. Tom has had some lathe tool points plated and its mighty interesting to see how the chips slide off the top. It's only a thin coating of chrome to be sure, probably not over a thousandth, but it adds a lot to the tool life.

"Taps don't give the chrome plate half a chance because you have to grind them in the flute on the cutting face of the teeth to sharpen them. Still, Tom says they stand up a lot longer than plain high speed taps in such stuff as Bakelite, whether they ought to or not. But drills tell a different story. You can grind back as far as you like and you still have the chrome cutting edge. Besides you keep the outside diameter to size and so avoid binding and squealing. And in deep hole work the slippery metal in the flutes helps clear out the chips.

"But say, Godfrey, the real case that Tom tells me about is reamers. If it's half true, and Tom doesn't often go off half-cocked, you know, it's a crime against reamer makers.

"Tom had a batch of piston pin reamers chrome plated quite a while ago. He took half a dozen reamers that had been discarded on account of being below size and sent them to be plated. Then he had them reground. He gets a lot more work out of them than he did before, and then, when they wear down to the low limit, he has them replated. It's got to be a sort of game with Tom to see how long they'll last. They've been replated nearly a dozen times now and are still going strong. Don't ask me to tell you the percentage of saving because I always did get twisted on percentages and it's so big you wouldn't believe it, anyhow. But we've gone a long way since you and I were in the shop, Godfrey. We thought that oxy-acetylene as a putting-on tool was the answer to the machinist's prayer, and now we have another one that seems to have just as many possibilities in the tool and gage line."

• IDEAS FROM PRACTICAL MEN

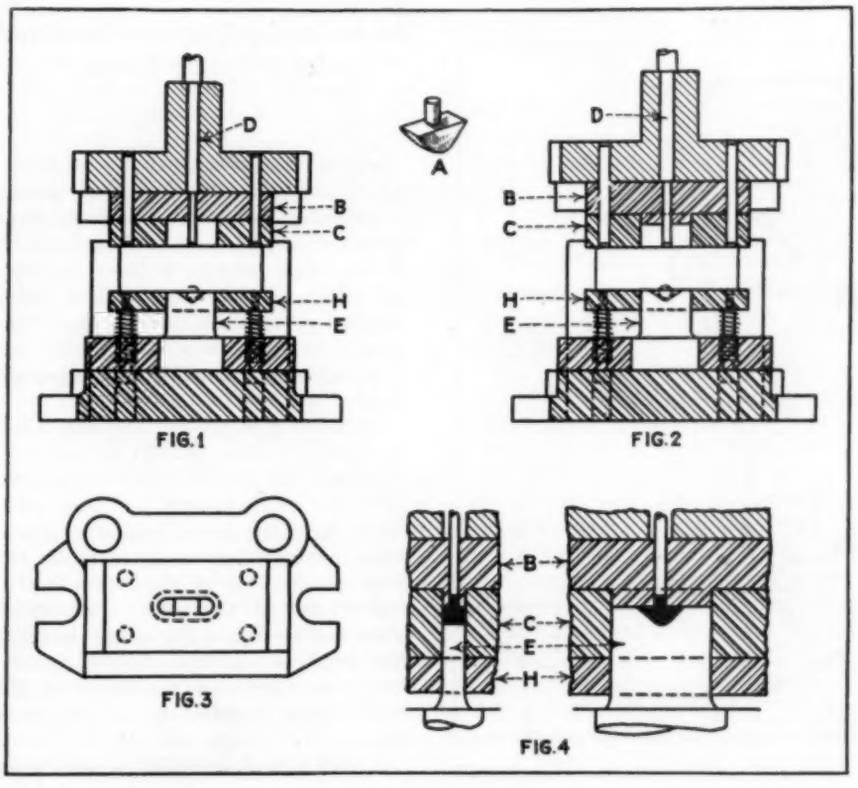
Press Tools for Contact Tips

ANDREW BEUSCH

In the illustration are shown two sets of tools for making contact tips, as at *A* (enlarged), from slugs cut from bars of copper and then annealed. In the first set of tools, Fig. 1, the plates *B* and *C* in the upper member are screwed and doweled to the punch-holder. Plate *C* has an elongated hole of the same width as that of the work. Plate *B* forms the flat on the top of the work and also acts as an extruding die for the stem. The knockout pin *D* retreats into the punch-holder while the swaging is being done and ejects the work on the ascent of the ram.

The lower member has an anvil at *E*, which is also the die for the curved lower part of the tip. Fitting around the anvil is the spring plate *H*, which, in connection with the anvil, forms a nest in which the slug is placed. These tools gave us considerable trouble because the heavy pressure required to swage the tips forced particles of copper between plates *B* and *C*, wedging them apart and permitting a thin flash to form. Furthermore, the plates would crack after limited service.

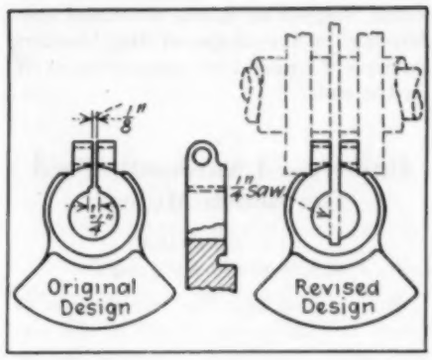
At the writer's suggestion, the upper member of the tools was redesigned, as shown in Fig. 2, the lower member remaining as it was. The plates *B* and *C* were made of the toughest tool steel available and considerably thicker. Plate *B* has a short pilot fitting snugly into the elongated hole in plate *C* to prevent the entrance of copper particles, obviating the objectionable flash. A plan view of the lower member of the tools is given in Fig. 3, while in Fig. 4 is shown the improved design of the lower member, slightly enlarged. These tools gave us no trouble whatever.



Two Operations in One

DUDLEY L. CURTIS

Recently, an engineering drawing came through for counterweights having specifications as shown at the left in the illustration. The usual boring and facing operations were required, also straddle milling and sawing at the bolt side,



which were to be followed by cutting a keyway.

By changing the design as shown at the right, the keyway was cut at the same time as the straddle milling and sawing were done, thus combining two operations in one. As originally designed, it would have been necessary to cut the keyway in a separate operation, so that two distinct set-ups would have been necessary.

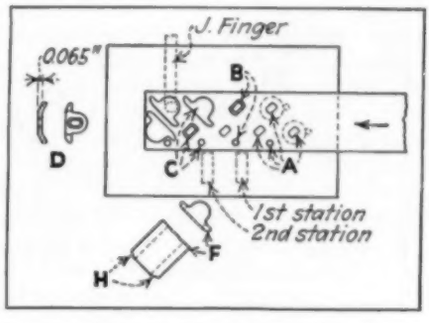
The changed design provides a better means of locking the counterweight to the shaft because the keyway has been shifted to the bottom of the hole instead of having it in the sawed slot. If the keyway were in the slot there would be likelihood that the pinch-binding action would be taken directly on the key, whereas with the key in the keyway at the bottom of the hole, a full-locking bearing on the shaft is assured.

Utilizing Blanking Punches for Bending and Forming

CHARLES F. KRAUT

Occasionally, separate bending and forming operations can be eliminated by grinding the blanking punches to suit conditions, as shown in the accompanying layout.

The sequence of operations is: *A*, pierce four holes; *B*, lead and countersink one hole; and *C*, lead, blank and countersink one hole. In this station the stock is fed against the jump finger stop. In the next station the jump finger comes into operation and two blanks are pro-



duced, formed as shown at *D* and conforming to the shape of the blanking punches *F*, which are ground as at *H* on the ends.

Improvised Automatic Feed for Bench Millers

J. F. CAVANAGH
Boston Wire Stitcher Company

Not so long ago, the introduction of labor- or time-saving stunts in the machine shop was usually accompanied by difficulties in obtaining such parts as small gears, pulleys and bearings. Today, however, standard small parts are readily obtainable at a fraction of the cost of making them in the shop, and in many shops these parts can be utilized in many ways in the making of special devices. By the aid of such standard parts, a battery of small bench millers was readily equipped with automatic feed at small cost and with gratifying results.

In the illustration is shown one of a battery of small bench millers used extensively for slitting, burring, light milling, and other secondary operations. The lever *A* is used for moving the table longitudinally, and on the opposite end of the shaft to which it is attached is mounted the sheave *B*. Utilizing small, adjustable, pedestal bearings, a ¾-in. drive shaft was mounted on the bench beside the machine. This shaft carries a sheave of suitable diameter and is connected to the sheave *B* by a round belt. The belt is given the right amount of tension to feed the work against the cut, and yet to permit the table to be returned to the starting position against its pull by the lever *A*, and also to permit slippage when the table has reached its stop.

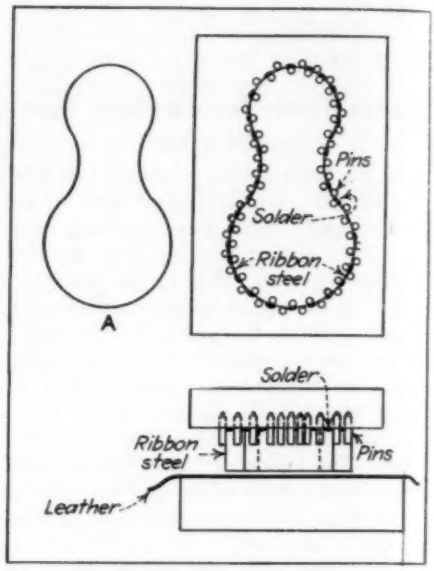
Quick-acting fixtures are, of course, essential with this rig, and the illustration shows one used in keyseating small studs for Woodruff keys. The fixture has a hole to receive the shanks of the studs, which are clamped by the spring-actuated plunger *C*. The plunger is released by contact with the stop *D* when the table is brought back to the loading position. With such fixtures and with the machines equipped with automatic feed, one operator is enabled to tend from two to six machines, according to the character of the operations. On the whole, the arrangement is well worth the small expense involved.

A Sectional Dinking Punch
Discussion

CHARLES KUGLER

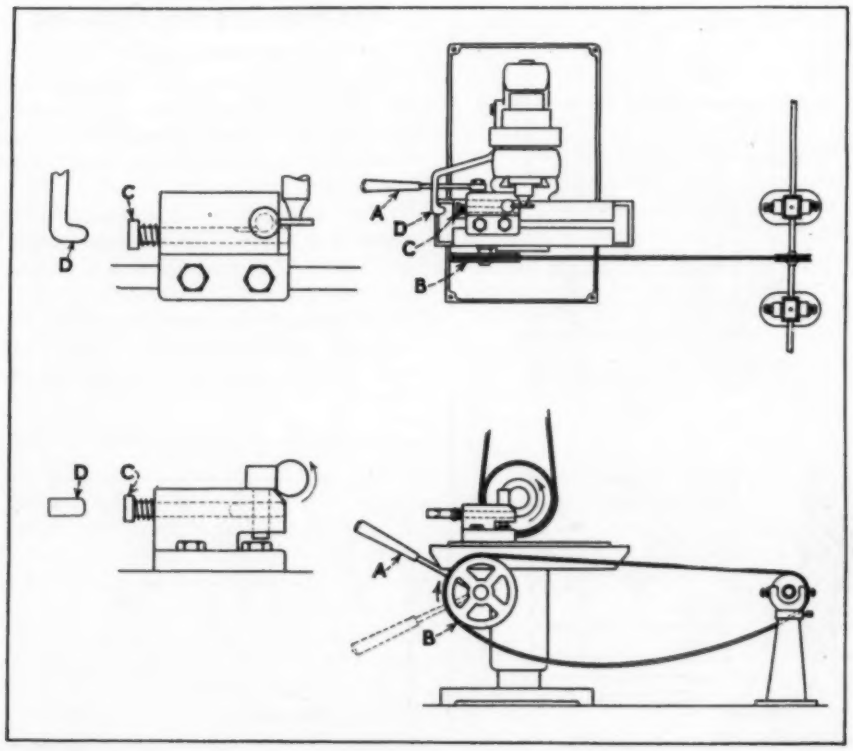
In an article under the title given above (*AM*—Vol. 76, page 1073), D. J. Reynolds describes a method of making a dinking punch, in which a body plate is machined to the correct shape and then spring steel is wound about it and is fastened by machine screws.

In making a dinking punch for cutting leather to the shape shown at *A* in the illustration, I used a much cheaper method than that described by Mr. Reynolds. Instead of making a body plate the shape of the work, I scribed the shape of the work on a flat plate. A series of staggered holes was drilled on both sides of the outline and pins were driven in them, as shown at *B*. A piece



of tempered ribbon-steel having one edge ground sharp was then placed between the pins and fastened by soldering.

The leather to be cut is placed on a wooden block having the end grain uppermost, the punch is placed over the leather and is struck with a mallet. If a large quantity of the pieces is wanted, the punch can be used in a press.



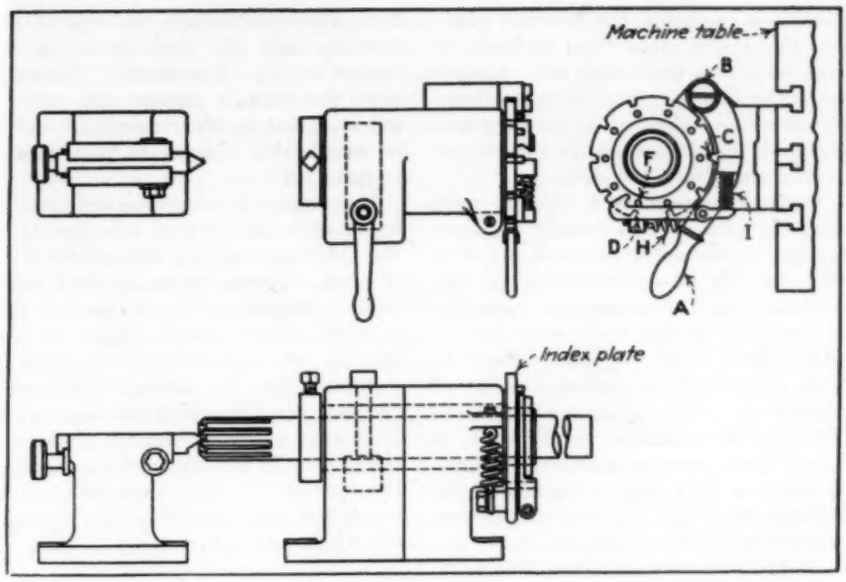
An Indexing Fixture Operated by a Single Lever

L. L. LOCKE

In the illustration is shown an indexing milling fixture in which the indexing is performed by pressing a single lever downward. The lever *A* is pivoted at *B*, the index plunger *C* being an integral part of the lever. The index plunger engages notches in the index plate in the usual way and is pulled out of engagement when the lever is pressed down.

To lever *A* is pivoted the index link *D* having a hook formed on one end to engage the pins *F* in the index plate. After the index plunger has been withdrawn from the notch, continued downward movement of the lever causes the hook on the end of the index link to engage one of the pins in the index plate and to rotate the index plate one increment, or, in this case, $\frac{1}{16}$ revolution, the downward movement of the lever being arrested by a stop, not shown.

A stiff helical spring *H* returns lever



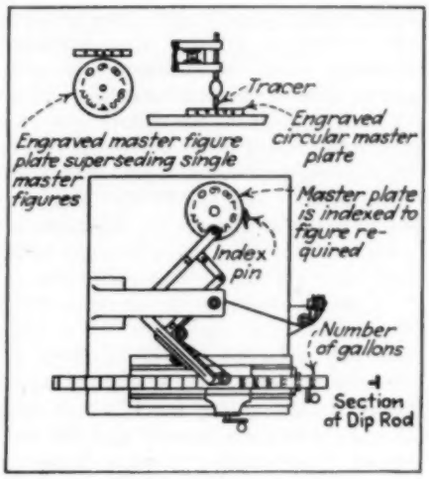
A to its normal position as soon as the downward pressure is released. Near the end of the return movement, the plunger enters the next notch in the index plate. Both the index plunger and the notches in the index plate are tapered on one side, so that any minor inaccuracy in the movement of the index plate will be corrected by the plunger being forced into the notch by the pressure of the spring *H*. The index link *D* is held in operating position by the spring *I*, and its hooked end is so shaped that it will be deflected outward by the pin that lies directly above it as the lever *A* is returning to its operating position. As soon as the end has passed the interfering pin, the spring *I* returns the link to its operating position.

The fixture is used for multi-splining the ends of shafts. The shafts are passed through the hollow spindle in the headstock and are held by a set-screw, the ends to be splined being supported by the tailstock center. Fixtures of this type can be used in many classes of index milling, and even in drill jigs. Different spacings can be had by using other index plates and changing the proportions of the operating mechanism to suit.

Engraving Machine Attachment

F. S. DOUGHTY
Windhill, Shipley, Yorkshire, England

In engraving figures on dip rods for finding the contents of large gasoline tanks, a great saving in time was made by use of the attachment illustrated. The dip rods are T-sections of drawn brass and the straight increment lines are engraved in the usual manner. For engraving the figures, which vary in from 5- to 10-gal. increments, using the single master figures supplied with the engraving machine made the work a slow process, since each master figure


Tracer
Engraved master figure plate superseding single master figures
Engraved circular master plate
Master plate is indexed to figure required
Index pin
Number of gallons
Section of Dip Rod

had to be removed and another located and clamped in alignment with the tracer. This changing of master figures took considerable time.

A disk of hard bronze, suitably machined and divided for the figures, was engraved from the master figures, size for size. It was then attached under the tracer by a central stud and was fitted with an index pin to engage holes in the periphery in alignment with the figures. The figures on the dip rods are one-quarter the size of those on the master disk and in engraving them, the figure required is dialled on the master disk and the process is repeated much more rapidly than when figures have to be removed and others located. In addition to the figures, the maker's name was engraved on the rods. This name was engraved on the master disk inside of the figure circle, so that following the letters made the process a simple one.

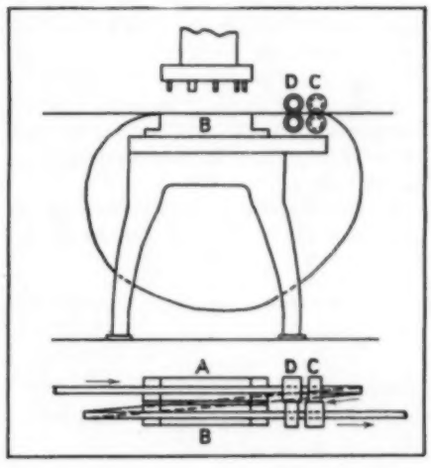
Doubling Press Production

R. H. KASPER
Master Mechanic, Steel Heddle Mfg. Co.

The illustration shows how two press operations were combined without any change in the dies, and with but a slight change in the feeding arrangement. Originally, the product was completed in two operations, and in endeavoring to reduce the cost of manufacture, progressive dies were considered, but were abandoned on account of the cost.

However, a satisfactory solution was reached by placing the two dies *A* and *B* in the press, as shown in the lower view, die *A* performing the first operation and die *B* the second operation. The bolster was extended to support an extra set of feed rolls *C*, which were geared to the original rolls *D*. Both sets of rolls were reduced in diameter through one-half of their length, but on opposite ends, so that one end only of each pair would be effective in feeding the stock. The larger diameter of each pair of rolls being the same, the stock was pulled forward the same amount by each.

The stock was passed through the rear die *A*, through both sets of rolls,



looped under the bed of the press, passed through the front die *B*, and again through both sets of rolls. In the upper view is indicated how the stock was looped under the bed of the press. The lower view shows how the stock was drawn through, the die *A* by the large ends of the rolls *D* and was drawn through the die *B* by the opposite ends of the rolls *C*, thus permitting two operations to be performed at one stroke of the press.

Equalizing Pressure of Vise Jaws—*Discussion*

FRANK C. HUDSON

I was much interested in the proposal of Frank W. Curtis (*AM*—Vol. 76, page 1235) to use balls in place of wax in the device of Francis Paquin (*AM*—Vol. 76, page 948) for equalizing jaw pressure in work holding vises. Judging from experience, it would seem better to round the large ends of the plungers in contact with the balls, into a sort of hemisphere. I believe the balls would "flow" more readily than flat ends.

Years ago we found that a conical or rounded end on a displacement plunger that acted in a closed chamber (not in a regular pump barrel) worked with less shock or impact than when it was made flat on the end. It would seem that the same effect would be even more pronounced in the case of balls.

Adjustable Jig With Parallel Connections—*Discussion*

E. F. TEIGH

Richmond, Surrey, England

In the article by F. Server, under the title given above (*AM*—Vol. 76, page 830), the following points seem to call for comment:

1. The jig appears to be unnecessarily complex for the particular work for which it was designed.

2. The position of the jackscrew is undoubtedly wrong, since its action will tend to bend the work between the supporting points on the cast-iron brackets.

3. So many moving parts in a small mechanism tend to cause a great amount of wear, resulting in increased maintenance cost.

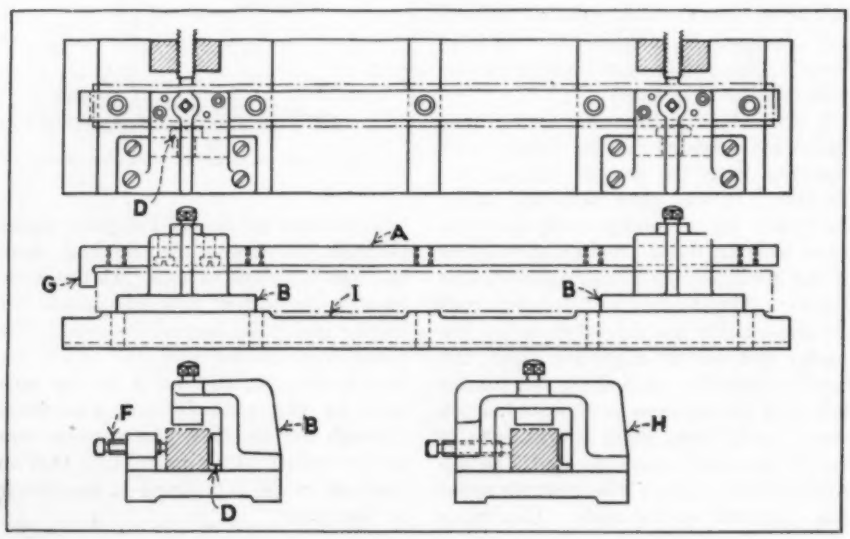
4. Any variation in parallelism of the work will throw unequal stresses on the eccentrics operating the bushing plate, and this might cause them to bend, or even to take a permanent set. Accordingly, the bushing plate, being relatively slender, would likewise be distorted and the guide bushings would be thrown out of alignment with the drills.

It would appear as if this jig were designed without very closely considering the fundamental requirements of a drill jig. It is assumed that in this particular jig, the anticipated variations in the size of the work were known. Otherwise it would have been difficult to have arrived at the correct amount of eccentricity of the clamping eccentrics. Knowing the variations in the work, it would have been comparatively simple to design a fixed type of jig having the requisite clearance to admit the largest piece. In drilling practice, it is accepted that under average conditions the lower faces of the bushings should be at least one diameter of the drills above the work. Unless this is so, the chips must be forced up through the bushings, wearing the holes and possibly causing the drills to bind and break.

The jig could have been designed as a fixed-plate jig, having a gap sufficiently large to admit the largest piece without the attendant trouble from excessive clearance when the smallest piece is in place. One of the fundamental rules in jig designing is that the clamping screws should be located directly over the points of support, unless the work is of such form that it will absorb the clamping stress without distortion. It must be admitted that work of a straight-beam form does not meet this requirement.

In the jig shown in the accompanying illustration, the jig plate *A* is permanently attached to the brackets *B*, the stop *G* being long enough to catch pieces of varying length. A button stop *D* is fixed in each bracket and the setscrews *F* are applied directly opposite. Two setscrews through the tops of the brackets hold the work down on the base of the jig. This method of holding down the work is perhaps not quite so quick as that in Mr. Server's jig, but it is considerably cheaper to provide and to maintain.

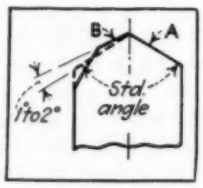
If necessary, the cast-iron brackets can be made in the form of a bridge, as at *H*. Although the jig will not be quite so open, the construction is very much stiffer. Regarding the cleaning of jigs, it is well known that a large, flat surface is very difficult to keep clear of chips and dirt. To eliminate this trouble the base plate has been cut away, as at *I*, so that only the supports under the work have to be attended to, enabling the operator to clean them of chips in much less time than if he had to clean the whole base plate.



A Cure for Drill Breakage

JOHN THOMAS

Recently, we have had trouble with drills breaking on an automatic screw machine job, the holes being drilled ¼ in. in diameter and 1 in. deep. The trouble was probably caused by some peculiarity of the stock, which was exceedingly tough and stringy. We would often break five or six drills in a single shift. At other times, there would be



no breakages for several days. An especially annoying feature of the trouble was that broken pieces of the drills would stick in the work and ruin other tools on the job.

Different makes of drills and all of the familiar tricks of grinding were tried, but all without any worthwhile improvement. Finally, it was thought that if we could produce a chip less in width than the cutting edge of the drill, the tendency for the chip to pack in the flutes would be overcome. This idea proved to be correct. The type of point to which the drills were ground may be a trifle radical, but it solved our problem. In fact, after several weeks of continuous running we have not had a single drill to break, and the original drill has been ground at least a dozen times.

In grinding the drill, the lip *A* was ground to the standard angle and lip *B* was ground at a somewhat greater angle with the axis (about one or two deg.),

and the lip was ground away for about one-half of its width, as shown in the sketch. The result was that lip *B* cut first and the chip was but one-half the width of the lip, being nearest to the center of the hole. Lip *A* also cut a chip one-half of its width, but farthest from the center of the hole. Thus the chip was divided between the two lips, the action being somewhat like that of a double-end boring bit. This point produced narrow, closely-coiled, wire-like chips that did not have the slightest tendency to pack in the flutes. Since each lip cut an independent path and the full depth of the feed, both chips were of the same thickness and were uniform, even with a wide variation in grinding.

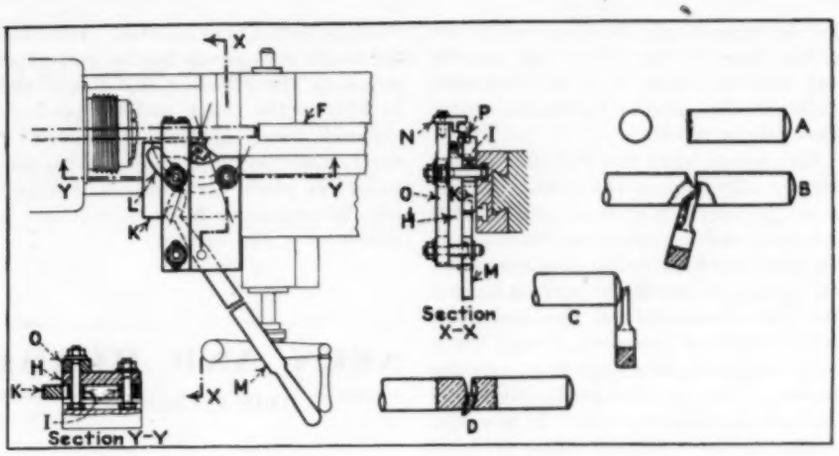
This type of point can be ground correctly by hand much easier than can the standard point because the thickness of the chip does not depend upon the grinding, but upon the feed. Practically all that is necessary is to see that lip *B* is at a greater angle with the axis of the drill than lip *A*. While we have yet had no opportunity to try drills so ground on deep-hole drilling, they might be useful for that purpose, especially since there is usually more or less trouble in getting the chips out of the hole.

Spherical Parting Attachment for a Bench Lathe

EMIL WITTMANN

It was necessary that a large quantity of brass pins, one of which is shown at *A* in the illustration, have one end convex and the other end concave. To avoid extra operations, the attachment illustrated was designed for cutting off the pins so that the convex end of one pin and the concave end of the next one could be formed simultaneously, as shown by the progressive positions of the tool at *B* and *C*. At *D* is a cross-section of the tool taken from below the center line. The bar stock was held in a collet and was located endwise by the rod *F* held in a drill chuck in the tailstock spindle.

Essentially, the attachment consists of the plate *H*, which is attached to the top of the compound rest and kept in distance from it by the bushings, or spacers *I;* the plate *K*, sliding between plate *H* and the top of the compound rest, and provided with the circular slot L, permitting the plate to swivel about the two bushings, or spacers; and the lever *M* engaging an angular slot in plate *K*. The lever is prevented from coming out of the angular slot by its movement being restricted by a pin contacting with the edge of the upper plate.



To steady the work, the bracket *N* is fastened to the strap clamp *O* and is adjustable to suit work of different diameters; vertically by elongated holes for the clamping screws, and horizontally by moving the strap clamp. The tool *P* is held in a groove in plate *K* and travels in an arc as the plate is swiveled.

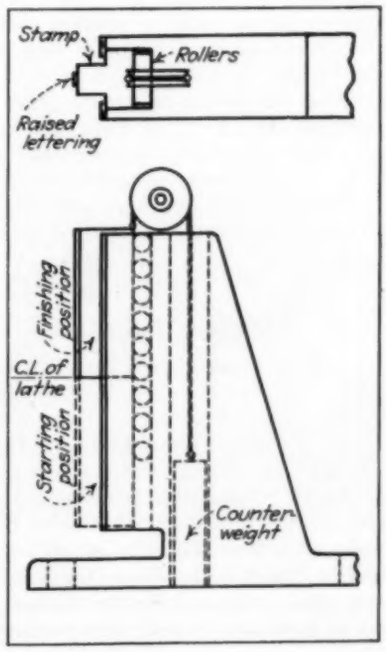
Rolling Letters Into Work
Discussion

C. A. COPPACK
Leicester, England

In an article under the title given above (*AM*—Vol. 76, page 832), Ernest C. Allen describes one of the difficulties in rolling letters into work in the lathe.

Had he tried flat stamps? Such stamps mounted as shown in the illustration overcome the objection to registering on the second revolution of the work, since after one pass they rise out of the way. The flat stamp, as distinct from the roller stamp, has many advantages. In the first place, it can be made from a matrix by the kneading process in the same way that typewriter type are made. The matrix is machine engraved and is an exact duplicate of what will appear on the work. The resulting flat stamp produced from the matrix by kneading will, of course, be in relief. It is vastly superior to the handcut product, in which the engraver generally concentrates on the top or printing face, whereas it is the face at the base of the groundwork that gives what is to be seen on the work. So much for the stamp itself.

In use, the stamp is held in a vertical slide at the rear of the work and is counterbalanced so that it will stay where it is put. Normally, it rests on an adjustable stop at the bottom of the slide, the stop being adjusted to bring the first letter of the inscription to the center height of the work. The stamp is brought into contact with the work by the cross-feed screw. As the work revolves, the stamp moves upward to the end of the inscription, where it remains until pushed down to the stop for the next piece of work.



Making Contour Forming Tools Without Calculations
Discussion

WILLIAM S. ROWELL

Referring to the article by Charles Kugler, under the title given above (*AM*—Vol. 76, page 1138), his solution of a contour problem seems far from convincing. Possibly a more detailed description would help to clarify matters so its advantages could be understood. For instance, the templets *A* and *B* are segments of an ellipse, yet nothing is said as to the positions of their axes in the parts used as gages. The illustration plainly shows the highest part of the

cutting edge of the forming tool to be in the plane of the center, yet we are told that the cutter is to be used with its *center line* in the horizontal center plane of the work.

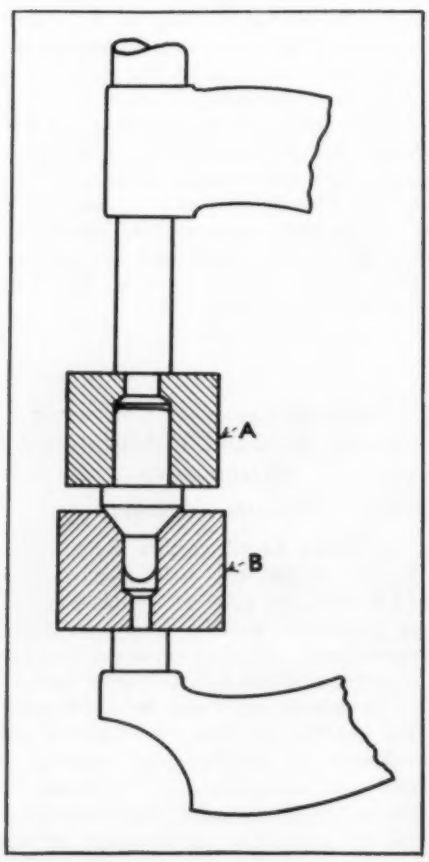
This would leave the high side of the cutting edge above the center of the work, in which position it would lack clearance and would refuse to cut. If the contour of the cutter is a symmetrical segment of an ellipse, and its highest point is set to cut on the horizontal center plane of the work, it will obviously not produce a groove of circular section. This would seem to be a case where generating the cutter form would be the easiest solution. May we have some discussion?

Measuring Counter Punches

EUGENE L. SOLTNER

Some diemakers are apparently unaware of a simple and accurate method of checking counter punches. This lack of knowledge has been brought to my attention so often of late that I am passing along to the readers of the *American Machinist* a method I have used for some time and which, aside from giving most accurate results, requires so little in the way of tools that any mechanic can make them in a short time.

Where counter punches are to be used in multiple in the same press tools they must be accurate duplicates. After having made one punch to the correct dimensions, the collars *A* and *B* are made to fit over the shank and the pilot, the collar *B* being, of course, machined to the required included angle. With these collars in place, their overall dimension can be measured by a micrometer, as indicated in the sketch.



SEEN AND HEARD

JOHN R. GODFREY

More About Balancing

It is one thing to balance a revolving member by locating its heavy side, drilling holes and filling them with cork. It is quite different if the balancing is being done on parts where weights have to be fastened on. One balancing machine of the static type upon which this work is performed is of beam stype. After the heavy and light sides have been located, and the heavy point turned at 90 degrees from the bottom on the balancing mandrel, the same weights which are to be placed on the member are actually used in the balancing test. A weight pan is provided on a bar, and this is adjusted at the same radius, to agree with the point where the weights are to be fastened on. It is a simple matter to place enough weights in this pan to balance the beam, and then fasten the weights on the part.

Other Uses of Hard Alloys

Hard alloys have other uses than to cut metal at unheard of speeds. Stellite, for example, is being used for wear-strips on boring bars to prevent chips from cutting the bar. It is also used for guide strips. In both cases it is welded to the bar and ground to the size desired. Motor builders are also using inserted valve seats to greatly increase the life of the cylinder block. These inserts are frequently faced with a hard alloy, such as Stellite, and valve grinding becomes a lost art.

Threaded Joints

Except in threaded pipe couplings we seldom find that the threads of a joint are used to hold pressure. Even here we use red lead, white lead or other compounds to fill any spaces between the threads. Some wind hemp or cotton fibre into the threads in addition to the compound. The difficulty of securing a perfect fit on both sides of the thread angle and at top and bottom makes it next to impossible to hold high pressures with screwed joints. Threads are extremely useful to hold a joint in place, but the joint should not be in the thread itself, unless absolutely necessary.

Tool Costs

Forty dollars seems a lot of money for a lathe tool. And the small shop man can hardly be blamed for thinking its too high and that he can't pay it. But checking up on a few figures of a lot of test runs gives some surprising figures on net costs. A good high speed tool lasted over 8 hrs. at 25 feet per min. on heat treated steel turning about 4 cu.in. per min. At 100 ft. it cut over four times as much metal per min. but it lasted less than two minutes.

Tantalum carbide tools were run from 100 to 300 ft. per min. and cut from 18 to over 50 cu.in. per min., lasting an hour and a half at 300 ft. Boiling this down into dollars and calling the high speed tool $5 and the other $40, gives some interesting figures. At 25 ft. per min. the H.S. tool only costs $0.002 per cu.in. of metal removed, but jumps to $0.014 at 50 ft. and to $0.120 at 100 ft. The tantalum carbide tool costs only $0.005 at 100 ft. and only $0.008 at 300 ft. Figured on the basis of tool life the H.S. tool cost $2.50 a minute at 100 ft. as against $0.09 for T.C. while the cost of T.C. jumps to $0.45 per min. at 300 ft. Net cost of tools depends on the amount of metal removed per hour and per dollar. It is more economical to run a tool at its highest efficiency even though its life is thereby shortened, because the machine is thus released more quickly for other jobs. For although the tool costs 45c. per min. at 300 ft. this speed gives a low tool cost per lb. of chips and makes the machine available for other work in approximately one-twelfth the time required by a H.S. tool at 25 ft. per min. and at one-third the actual cost for tools.

Single-Purpose Machines Lose Caste

Strictly single purpose machines have lost caste with automobile engineers, although in many cases these same machines were designed and built for the motor car industries. Machines for boring connecting rods and cylinder blocks are now wanted with adjustable centers. Fixed center machines are being given a black eye by engineers who want to change designs without scrapping dozens of expensive machines. All of which indicates more frequent product changes than before, and a realization that the difference in cost of work between machines of the two types is frequently offset by the advantages of flexibility.

SHOP EQUIPMENT NEWS

Morton Horizontal Boring, Drilling, Milling Machine and Draw-Cut Planer

A universal machine combining the features of horizontal boring, drilling, milling, vertical milling, right-angle boring, shaping, planing and slotting has been developed by the Morton Mfg. Co., Broadway and Hoyt St., Muskegon Heights, Mich. The machine has a 48-in. cutting stroke and a bed 14 ft. long. It provides a horizontal feed of 9 ft., and a vertical feed of 48 in. on the column.

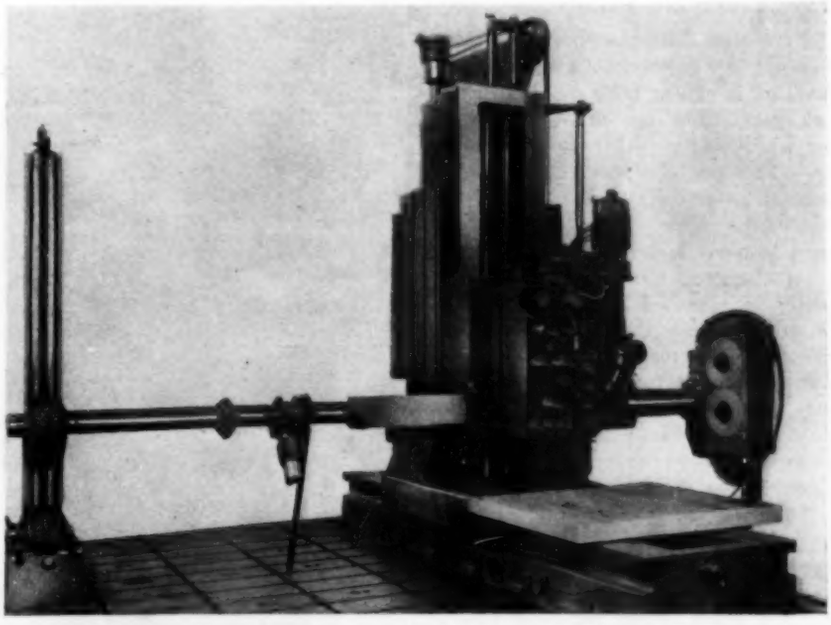
The bed is a single casting provided with a large bearing surface and square rail bearings. The column is cast integral with the bottom saddle and is machined and fitted to the base. The saddle or vertically moving apron is closely fitted to the column and provided with means for compensating for wear. It forms the bearing surface for the reciprocating ram, and also supports the feed actuating, cutting and working mechanism of the machine.

The ram is approximately 8 in. square and is ground. Rack teeth are cut from the solid on the back side of the ram for the purpose of applying the power drive when planing, or feed when boring. Within the ram and journalled on anti-friction bearings is a 4½ in. diameter heat-treated arbor of special construction. This arbor is designed to compensate for extreme torsional strains.

An improved feed change gearbox having a range of 30 feed changes for boring and milling is provided. The quick change gear makes possible changing from boring or milling to planing or slotting within one minute. Milling feeds are designed for quick changing in either direction by a lever shift. Rapid power traverse is provided for the power movement in all directions.

The ram is reciprocated by means of a reversing motor drive. The stroke may be adjusted to any position or made to any length within the capacity of the machine by moving the tappets located on the front of the control box. Drive for boring and milling comes from the same motor as for shaping and planing. Power is transmitted through mitre gearing through a vertical shaft to the operating mechanism contained in the vertically moving apron. A gearbox at the end of the ram contains a sliding change gear, which in connection with the variable speed motor, gives a wide range of speeds for boring and milling. Both intermittent and continuous, horizontal and vertical feeds are provided. A wide range of feeds may be used for continuously feeding the ram in either direction for boring or milling.

The machine is equipped with a d.c., reversing, planer-type motor of not less than 10 hp. Speed variation of the motor ranges from 250 to 1,250 r.p.m., and is so arranged that the speed may be varied either on the cutting or return stroke. The machine can be furnished with any length of cutting stroke, horizontal feed on the bed or vertical feed on the column. The machine can be furnished with various production attachments and equipment as follows: floor plate, work tables, boring bar and outer support, vertical milling attachment, spherical boring head, right-angle slotting attachment, and vertical drilling attachment. Approximate floor space required is 14x16 ft., and the weight of the machine with various attachments is 44,000 lb.

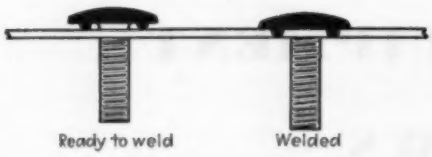


Morton Horizontal Boring, Drilling, Milling Machine and Drawcut Traveling Head Planer with the boring bar and outer support for the boring bar in position. The outer support for the boring bar has a 30-in. horizontal feed and a 60-in. vertical feed, both being hand operated

Ohio Welding Bolt

Projection welding has eliminated the use of bolts in some cases. In other cases, however, a bolt of suitable design can be used to take advantage of the projection welding process. Therefore,

the Ohio Nut & Bolt Co., 600 Front St., Berea, Ohio, has developed welding bolts in two styles. The prongs or lugs on the bolt head provide for projection welding to sheet metal, using resistance welding machines. The bolts are welded into permanent position and cannot turn when tightening nuts. The Type G1 has the welding lugs on the bottom of the head, and the Type G2 has the welding lugs on the top of the head. The bolt with the welding lugs on the top of the head has the advantage of leaving one side of the sheet clear of obstructions and hence is desirable where a flush surface is required, either for appearance or for clearance.



Ohio Type G1 Welding Bolt

"Red Ring" Gear Lapping Machine

Inaccuracies found in heat-treated gears involving involute curvature, spiral angle, eccentricity and tooth spacing are dealt with by the "Red Ring" gear lapping machine announced by the National Broach & Machine Co., Shoemaker & St. Jean Sts., Detroit, Mich. The lapping machine operates on the crossed axes principle employed for the gear cutting machine (*AM*—Vol. 76, p. 1206). In the design of this machine the economic limits of lapping have been extended. It can be used to correct the above four types of inaccuracies on plain spur and helical spur gears used in power transmission, timing and gear reduction sets. Normally, lapping time will run from 2 to 5 min., floor to floor. One operator can handle from four to six machines, inasmuch as the entire operating cycle is automatic, providing for a given number of strokes on each side of the gear tooth, with an automatic stop.

In the Red Ring machine a specially processed lap finished to a tolerance of 0.0002 in. is run at high speed with the work gear. The lap drives the work gear which has no other power connection. The axis of the work gear arbor is set at an angle with that of the lap gear shaft. This angle varies between 5 and 15 deg. In addition to the crossing of the axes, the work gear is constantly reciprocated across the face of the lap gear while the machine is in operation. This produces a continuous sliding of the lap tooth surface over the gear tooth surface. By reason of the crossed axes principle it is practicable to end lap a gear having a shoulder at one end larger than the outside diameter of the gear itself. Both "cramp action" lapping and "power tailstock action" lapping can be done on the machine. A lap will satisfactorily process from 500 to 1,000 gears before recutting and it may be recut twice. Although the lap teeth wear, their shape remains constant because of the self-generating action between the lap and the gear. A lap which processed 1,000 gears showed a loss of accuracy in involute curvature of but 0.0005 in.

The inclosed base of the machine houses the drive, timing and switching mechanism. A table carries the fixed lap shaft, while an adjustable column carries the reciprocating head, which also carries the power brake for loading the work gear arbor. The head has both hand and automatic feed for adjusting the initial center-to-center distance between the gear and the lap and for feeding the gear against the lap during cramp operation. Power is furnished by a ¾ hp., flange-type motor. Power is transmitted through a gearbox to two shafts, one vertical and one horizontal. The horizontal shaft is belt-connected to the lap shaft on the machine table. The vertical shaft drives an eccentric which operates through the column to reciprocate the work slide carrying the gear arbor.

The column has angular adjustment. It is equipped with a vernier scale and may be set to 6 min. of arc. By adjusting the column setting, the bearing on the gear can be shifted from one end of the tooth to the other. A handwheel and ratchet at the top of the head controls the vertical adjustment of the work slide and also its feed. At the right-hand end of the work arbor is the hydraulic loading brake.

Automatic timing controls are located in the base of the machine. These consist of two levers which govern the action of the automatic switches. By means of these lever settings the lap is rotated a given number of revolutions in one direction, reversed for a given number of revolutions and stopped.

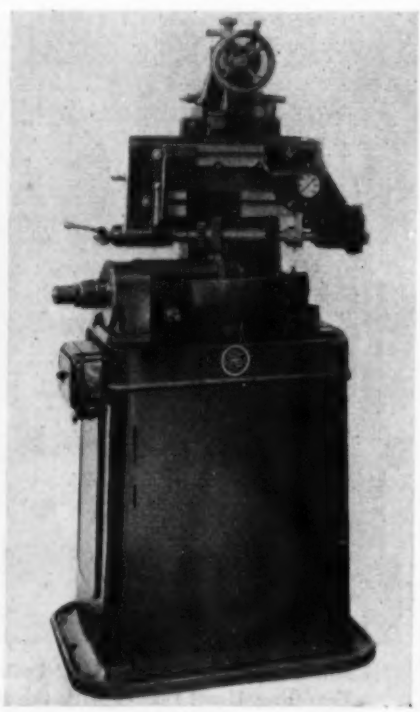


Fig. 1—"Red Ring" Gear Lapping Machine with the work set up

Fig. 2—Close-up of table, work slide and controls, showing the wide angle between the axes of gear arbor and lap shaft and also the power tailstock and load indicator

Torit No. 23 Soldering Outfit

A small torch with four different tips, a soldering copper, rubber tubing and a connection for the small "Presto" acetylene tank constitutes the Torit No. 23 soldering outfit placed on the market by the St. Paul Welding & Mfg. Co., 209 W. 3rd St., St. Paul, Minn. The outfit is for soldering, tempering, light brazing, wire splicing and other small jobs requiring heat. It is not intended for welding. No oxygen or compressed air is required. The necessary air for combustion is syphoned through the tips.

"Verson" Allsteel Straight-Side Double Crank Presses

Welded-steel construction is used for the line of straight-side double-crank presses developed by The Allsteel Press Co., Inc., 12015 S. Peoria St., Chicago, Ill. Illustrated is a "Verson" press which is understood to be the largest of the type constructed by the welded steel plate method. It is of 350 tons capacity with 48x140-in. bed area, 48x132-in. area of slide flange, 10-in. stroke, 20-in. shut height, 154-in. height over-all. It occupies 82x190-in. floor space and weighs 100,000 lb. complete.

The press is double geared and has twin drive and two balance wheels, one on each end of the high-speed back-shaft. The frame is of the 4-piece tie-rod construction, and the crown is of the box type, braced to support the main bearings. The bed is built flush with the floor, no pit being necessary. Uprights are of tubular construction, the plates being bent at the corners and welded centrally. The ram is of the double housing type and is contained within long ways at all points of the stroke. The ram is spring counterbalanced.

Gibways are integral with the uprights and are bronze faced. Adjustment for wear is provided by heavy steel gibs which are also faced with bronze. Tie-rods are heat-treated and are shrunk in. The crankshaft is made from a heat-treated alloy steel forging turned and ground. Gears and pinions are steel with cut teeth. The back-shaft runs in roller bearings and lubrication is provided by two force feed units located on each side of the press.

The clutch is of the multiple-disk type and is operated by hand and foot air trip. Drive is by individual motor and V-belts. The ram is adjusted by a reversing motor with pushbutton control. The brake is self-releasing. The welded steel construction affords savings in floor space, foundation costs and power consumption due to the compactness and lessened weight.

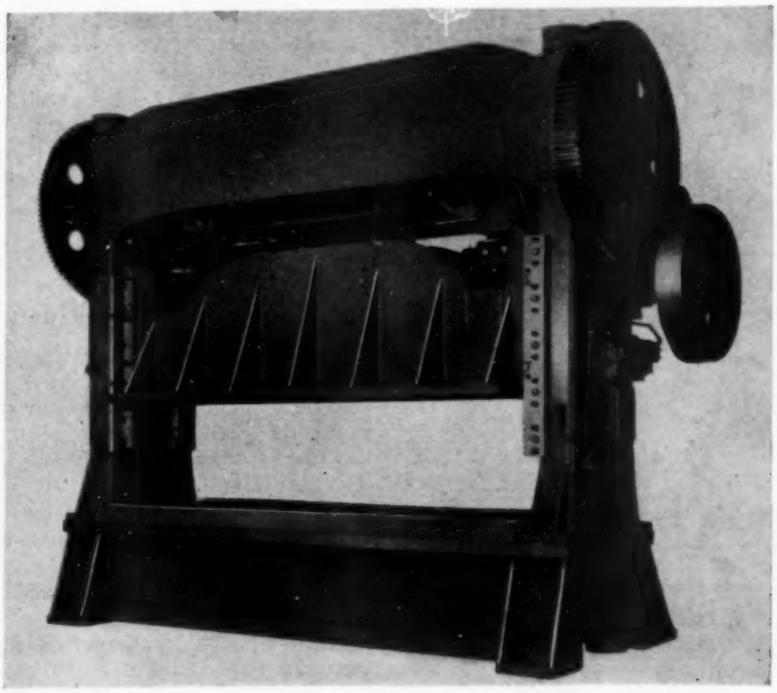
Monorail Trolley Unit with Rubber Drive Wheel

The American Monorail Co., 13107 Athens Ave., Cleveland, Ohio, has developed a motor-driven trolley in which a large pneumatic tired wheel is used to drive on the bottom of the Monorail section. The high coefficient of friction between the rubber wheel and the steel rail results in a more powerful drive unit and wear of the rail is eliminated. Structural simplicity is obtained by driving one wheel in place of the conventional two or four wheels as at present. The same type of drive has been applied to cranes.

The trolley makes use of motorized speed reducing units available in all current characteristics and voltages as well as in speed reduction ratios. Where close control is required, variable and multi-speed motors may be employed, but on a great many applications it is possible to use a squirrel-cage motor. The drive permits the use of power travel on the narrow flange rails which was previously impractical because of the limited tread width available. It also permits application of power travel to existing track systems having limited throw switches.

Pangborn Type "DF" Blast Helmet

A blast cleaning helmet designed to afford comfort and safety has been placed on the market by the Pangborn Corp., Hagerstown, Md. This Type DF helmet employs filtered washed air, of which the flow can be regulated to satisfy breathing requirements. A soft rub-

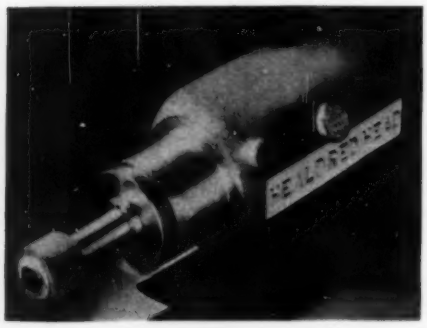


Adjustable skull cap and sweatband brings the vision window to correct eye position. Interior cloth cape prevents seepage of dust from underneath the shoulders

ber tire holds the vision window glass securely, but the operator may remove or replace the glass quickly. Seepage of dust from underneath the rubber cape, which covers the operator's shoulders, is prevented by a dust-proof cloth cape which can be drawn up by easy-running draw strings. For the comfort of the operator the adjustable sweatband may be adjusted to any size or shape of head. All exposed parts of the helmet are made of para rubber to give resistance to abrasion.

"Red Head" Wheel and Boring Heads for Heald Machines

Wheel and boring heads now supplied by the Heald Machine Co., Worcester, Mass., now bear the trade name "Red Head" and the name panel on the front is painted red for identification. These heads are for Heald internal grinders and boring machines. These wheelheads are the result of extensive redesign and testing. The old types 21, 12, 18 and 20 are now superseded by types 43, 45,



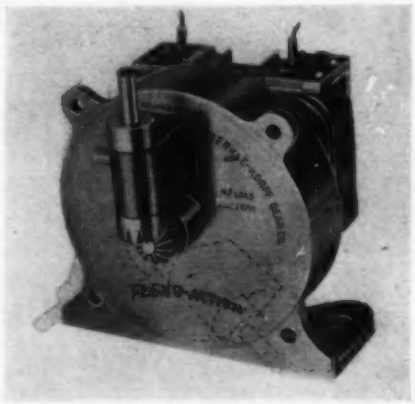
47 and 49. Corresponding types used on the No. 81 machine are 83, 85 and 87, which have bearings and quills interchangeable respectively with the 43, 45 and 47 types. The type 81 is a new size, having smaller bearings than the old type 21, and capable of operating speeds up to 42,000 r.p.m. for greater efficiency in small hole grinding.

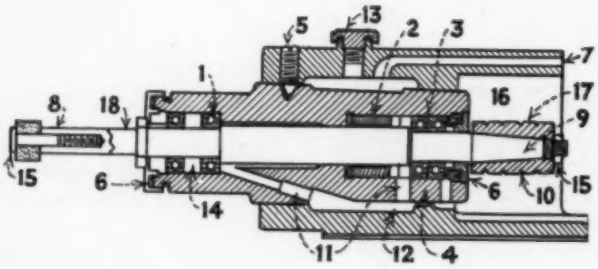
The Type H wheelhead, designed for heavy thrust grinding, will remain unchanged for the present.

Referring to the accompanying drawing, the following features of construction are presented: (1) Special super-precision wheelhead bearings with Formica retainers. These bearings are inspected in pairs for eccentricity of inner and outer races, and face runout. Over-all tolerance never exceeds 0.0002 in.; (2) Bearings held under a definite axial load, and spindle is supported on four rows of balls at all times; (3) Outer races of rear bearings free to move axially with the preload governed by springs; (4) Bearing sleeve is held in a ground taper fit in solid cast-iron body; (5) Sleeve held in place by one screw, which is not near bearings. Careless tightening cannot cramp or distort bearings; (6) Close fitting double seal end caps prevent entrance of abrasive dirt and water; (8) Wheel spindle ground all over and bearing seats held to limits of 0.0001 in. Spindles and quills run true within 0.0002 in. at extreme end; (9) Pulleys held on a taper; (11) Felt plugs filter oil and prevent dirt in oil from reservoir led directly to bearings with separate oil supply to each set; (16) Open pulley construction facilitates changing of belts; (18) Naked, sleeve or quill-type spindles can be furnished.

Merkle-Korff Reversible Power Reduction Unit

The Merkle-Korff Gear Co., 213 N. Morgan St., Chicago, Ill., has supplemented its line of small power reduction units with an integral motor drive for low torque requirements. This product consists of an assembly with two-pole reversible motor. It is designed to start, stop and run in either direction under the control of simple switching means. As standard, it is supplied for 115 volts, 60 cycles. Special units can be furnished for any voltage from 15 to 230 and for any frequency from 25 to 60 cycles. The device operates at a full-load speed of 1,500 r.p.m. and no-load speed up to 2,600 r.p.m. It has an input of 38 amp. and 20 watts. It can be furnished with either horizontal or right angle drive. Over-all dimensions are: depth, $3\frac{7}{16}$ in.; height, $3\frac{5}{16}$ in.; and width, $3\frac{11}{32}$ in.

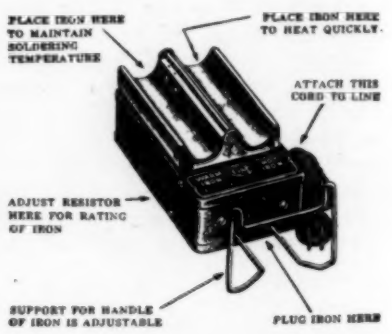




Cross-section of "Red Head" Wheel and Boring Head for Heald Internal Grinders or Precision Finish Boring Machines

"G-M" Soldering Iron Stand

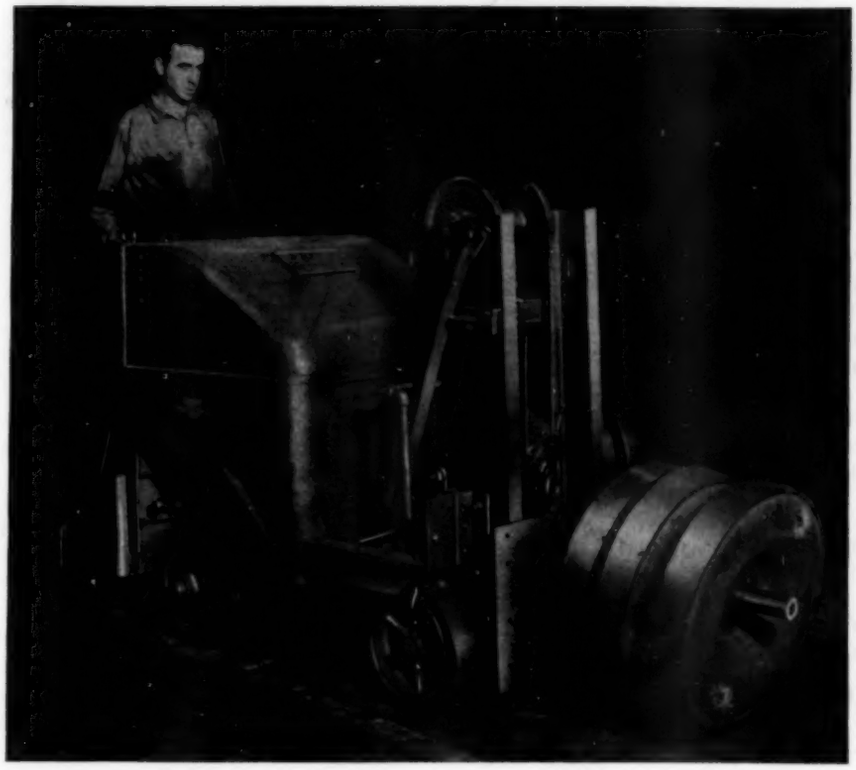
G-M Laboratories, Inc., 1735 Belmont Ave., Chicago, Ill., has announced a soldering iron stand that effects savings in power consumption and overcomes many of the principal soldering troubles. The stand keeps the iron at the correct temperature, and the tip of the iron will


PLACE IRON HERE TO MAINTAIN SOLDERING TEMPERATURE
PLACE IRON HERE TO HEAT QUICKLY
ATTACH THIS CORD TO LINE
ADJUST RESISTOR HERE FOR RATING OF IRON
SUPPORT FOR HANDLE OF IRON IS ADJUSTABLE
PLUG IRON HERE

remain well tinned for weeks. The stand has two cradles. When placed in the left-hand cradle the iron receives only sufficient voltage to keep it at the minimum but proper soldering temperature for immediate use. When the iron is placed in the right-hand cradle, full line voltage is automatically applied.

Clark Tructier Ram

For lifting, carrying and tiering strip steel and wire in coils, heavy wheels, dies, tires and machine parts of awkward shape, the Clark Tructractor Co., Battle Creek, Mich., has developed the Tructier Ram. The ram is 8 in. in diameter and has a standard length of 30 in. It is anchored to a vertical plate. The 2-ton model is capable of carrying the rated load at not more than 15 in. from the plate. Also built is a 3-ton model. Optional minimum height of the ram ranges from 6 to 20 in., and

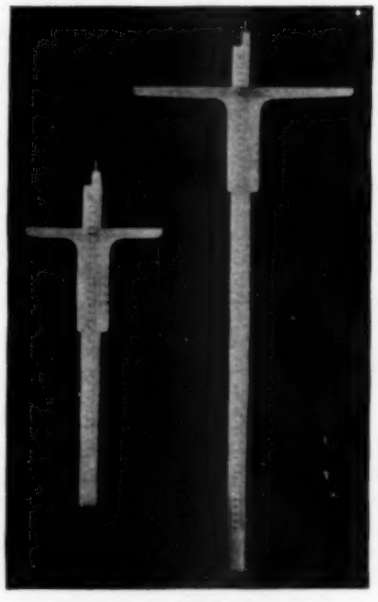


Clark Tructier Ram Truck for transporting large, awkward rings, dies or wire

maximum heights from 54 to 60 in. Truck is gas-powered and has a speed of 1 to 4 miles per hour. Rear-wheel drive and four-wheel steering makes for balance and mobility.

Mauser Depth Gages

Two sizes of Mauser depth gages are being introduced in the United States by the George Scherr Co., 128 Lafayette St., New York, N. Y. These gages have a 6½-in. and a 3½-in. scale respectively. Both are fitted with a vernier reading to 0.001 in. The sliding scale is fitted to the body of the tool so that a fine feel is secured for the depth measurement. The hardened pin on the end of the scale is adjustable for wear, being adjusted by loosening a small screw and resetting to the correct dimension.

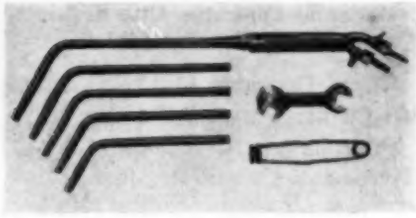


Olsen-De Shazer Strain Gage

Relative motion of the gage points is always parallel in the Olsen-De Shazer strain gage placed on the market by the Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa. Parallel motion of the point is transmitted through the levers and a plate fulcrum system to the dial indicator. The gage points, having a 30-deg. angle, are used in drilled holes, which give accurate readings on repetitive examinations for stress or deformation in the structure under investigation. The frame is constructed of stainless material and is not subject to changes in temperature. The illustration shows instruments of both the 10-in. and 2-in. gage lengths.

Purox No. 28 Welding Torch

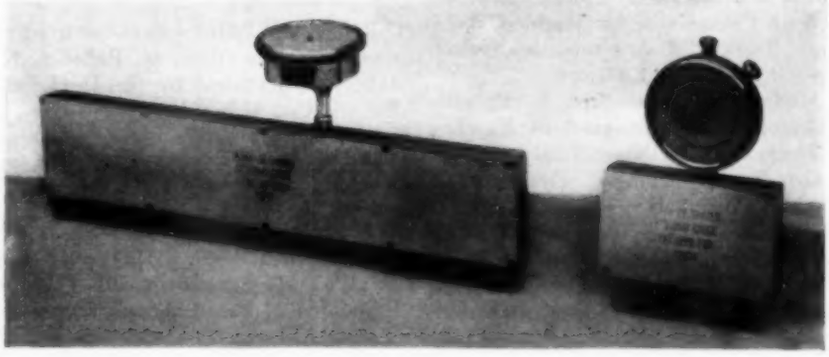
The Linde Air Products Co., 30 E. 42nd St., New York, N. Y., has announced the Purox No. 28 welding torch which will handle heavy-duty work as easily as the average job. The No. 28 torch is similar to the No. 20 but is somewhat different in design. Ten one-piece, 60 deg. goose-neck tips, numbered from 6 to 15, are available for use with this



torch. By means of a union nut these tips may be adjusted to point in any direction. Thus, overhead or vertical welding can be accomplished without any change in the normal grip of the torch handle. Tips Nos. 6, 8, 10, 12 and 14 are furnished, giving the torch a range from 16 gage sheet up to heavy castings. By using Purox No. 21 cutting attachment, steel up to 2 in. in thickness can be cut. By means of an adaptor Purox No. 11 welding torch tips can be used on both the Purox No. 28 and No. 28B torches. Thus the torch can be adopted to the lighter welding field.

Left—Mauser Depth Gages have a fine "feel" for accurate measurements

Below — Olsen-De Shazer Strain Gages may have the indicators mounted horizontally or vertically



• PATENTS •

DECEMBER 6, 1932

Metal-Working Machinery

Draw-Cut Shaper Table. Henry E. McLeod, West Drayton, Middlesex, England. Patent 1,889,930.

Metal Milling Machine. Robert James McLeod, West Drayton, Middlesex, England. Patent 1,890,399.

Tools and Attachments

Surface Plate. Carl Edvard Johansson. Detroit, Mich. Patent 1,889,897.

Electric Welding Tool. John M. Larsen, Grand Rapids, Mich. Patent 1,889,991.

Bearing Babbitting Device. Claire A. Nickles, Ponca City, Okla. Patent 1,889,999.

Machining Apparatus. Ottis R. Briney, Pontiac, Mich. Patent 1,890,146.

DECEMBER 13, 1932

Metal-Working Machinery

Hydraulically Operated Machine Tool. Raymond A. Carlson, Rockford, Ill., assigned to Rockford Drilling Machine Co. Patent 1,890,495.

Grinding Machine. Philip H. Hutchinson, Montclair, N. J., assigned to General Motors Corp. Patent 1,890,854.

Tools and Attachments

Boring Bar for Use Upon Pipe Coupling Blanks or the Like. William G. Benninghoff, Cleveland Heights, Ohio. Patent 1,890,452.

Grinding Gage. Frederick Jackson Pratt, Ferndale, Mich. Patent 1,890,827.

Processes

Method for Twisting Crank Shafts. Henry M. Wolfe and Corrington A. Nichol, Muskegon, Mich., assigned to Continental Motors Corp. Patent 1,890,635.

DECEMBER 20, 1932

Metal-Working Machinery

Head-Stock for Machine Tools. Stanley W. Bath, Shrewsbury, Mass., assigned to John Bath. Patent 1,891,220.

Work Piece Guide for Machine Tools. Karl Tessky, Esslingen-on-the-Neckar, Germany. Patent 1,891,290.

Milling Machine. Fred A. Parsons, Milwaukee, Wis., assigned to Kearney & Trecker Corp. Patent 1,891,356.

Grinding Machine. Frederick J. Theler, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,891,657.

Grinding. George W. Binns, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,891,661.

Machine Tool. Clement Booth and Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,891,662.

Grinding Machinery. Clement Booth, Cincinnati, Ohio, assigned to the Cincinnati Grinders Incorporated. Patent 1,891,663.

Machine for Finishing and Tapping Nut Blanks. Joseph Mercadante, Larchmont, N. Y., and Alfred Morris Thompson, Newark, N. J., assigned to Dardelet Threadlock Corp. Patent 1,891,721.

Grinding Machine. Alfred G. Plimmer, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,891,777.

Gas Cutting Machine. James L. Anderson, Closter, N. J., assigned to Air Reduction Company, Incorporated. Patent 1,891,880.

Die-Casting Machine. Nathan Lester, Cleveland, Ohio, assigned to Precision Castings Co., Inc. Patent 1,891,894.

Tools and Attachments

Grinding Wheel Guard. Fred J. Trimble, Maywood, Calif. Patent 1,891,696.

Processes

Method of Modifying Internal Strains in Metal Objects. Frederick C. Langenberg, Edgewater Park, N. J., assigned to United States Pipe & Foundry Co. Patent 1,891,234.

Method of and Means for Bending Tubes. Lester W. Snell, Alton, Ill. Patent 1,891,338.

• TRADE PUBLICATIONS •

BERYLLIUM COPPER. Publication B-21 of the American Brass Co., 25 Broadway, New York, N. Y., describes beryllium copper, an alloy that shows improvement in tensile strength and fatigue resistance when heat-treated. The heat-treated material possesses higher tensile strength, fatigue limit and hardness than any other commercial copper alloy.

FURNACES. "Atmosphere Control Furnaces" is the title of Bulletin No. 1132 just published by the Hevi Duty Electric Co., Milwaukee, Wis. The bulletin describes the Hevi-Duty feature of controlling atmospheres in its box-type furnaces.

INDEX TO A.S.T.M. STANDARDS. Issued as of October, 1932, is the yearly index to A.S.T.M. Standards and Tentative Standards of the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. The 441 A.S.T.M. standards and 226 tentative standards in effect on the above date have been indexed under appropriate key words according to the materials or subjects to which they apply.

MICRO ANALYSIS OF METALS. E. Leitz, Inc., 60 E. 10th St., New York, N. Y., has published two bulletins as follows: Bulletin No. 2 "Darkfield Microscopy for Micro Analysis of Metals" and Bulletin No. 3 "Leitz Micro-Metallograph Simplified Model MM-2." These two publications are of interest to those engaged in metallurgical studies.

MOTORIZED SPEED REDUCERS. Bulletin No. 125, issued by Sterling Electric Motors Inc., Telegraph Road at Atlantic Blvd., Los Angeles, Calif., is entitled "The Sterling System of Direct Power Application." The bulletin describes and illustrates the various forms of motorized speed reducers built and shows many applications.

RIVET BOLTS. Reports Nos. 2304 and 2310, covering tests carried out by the Testing Laboratories of Columbia University, show the relative displacement under load on various types of joints put together with Dardelet "Rivet-Bolts" and hot-driven rivets. The reports are available from the Dardelet Threadlock Corp., 120 Broadway, New York, N. Y.

STEEL SHOP FURNITURE. The Standard Pressed Steel Co., Jenkintown, Pa., has published Form 454 on "Hallowell" Stools, Chairs and Tables of Steel, many of which are adapted to shop use, also showing folding tables of steel, work benches, tool stands and shop trucks.

SPEED CONTROL. Bulletin T-5645, issued by the Reeves Pulley Co., Columbus, Ind., is devoted to automatic variable speed control utilizing the Reeves variable speed transmission. The booklet treats of electric automatic speed control and mechanical automatic speed control, describing both devices fully and showing quite a few applications of either type.

TENSILE TESTING MACHINE. Published by The Linde Air Products Co., 30 E. 42nd St., New York, N. Y., is a 15-page illustrated bulletin describing the Oxweld portable tensile testing machine for testing welds and qualifying welders.

TOOLS. The O. K. Tool Co., Inc., Shelton, Conn., has issued a circular "O. K. Combination Tools" illustrating the application and design of the O. K. cutter blades as applied to combination tools for core drilling, reaming, boring, counterboring, facing, hollow milling, and trepanning.